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FOREST INSECT CONDITIONS IN THE UNITED STATES 1969

FOREST SERVIC

UNITED STATE
DEPARTMENT O
AGRICULTUR

FOREWORD

This is the 20th annual report on the scope, severity, and trends of the more important forest insect infestations in the United States. It also summarizes the active programs undertaken by land managers to check resulting damage and loss. Although compiled primarily for public and private land managers to keep them abreast of insect conditions on their and neighboring lands, the report is also useful to students and others interested in forest insects and their impact on the environment. Volumes kept over the years serve as useful historical records of forest insect trends and occurrences of outbreaks.

Effective forest pest control programs require responsible administration and sound technology to discover and evaluate outbreaks. During 1969, 560 million acres of forest land were examined, both from the air and ground, by Federal Pest Control personnel to detect and appraise forest pest infestations. Twenty-six States participated in the program, sharing in the cost of surveys and evaluation on non-Federal lands. Forest Pest Control personnel in the South began using a more efficient survey procedure for evaluating southern pine beetle outbreaks. The method utilizes aerial color infrared photographs, ground checks, and radiographs. This system was used to evaluate 80 southern pine beetle outbreaks in 1969, providing land managers with statistically reliable data on size, intensity, and trend of the infestations.

Issuance of the President's Executive Order establishing the Environmental Quality Council and the Citizens Advisory Committee on Environmental Quality placed increased emphasis on use of pesticides that have minimal environmental impact. The Forest Service and cooperating agencies continued to stress the policy of not using persistent pesticides in action programs where research and field tests have demonstrated that non-persistent chemicals or non-chemical methods will accomplish control objectives effectively and safely. Integrated control utilizing natural enemies, forest cultural practices, and pesticides to reduce forest insect populations to manageable levels received more recognition in 1969 and is expected to become the focal point in control of forest pests in the years ahead.

Grateful acknowledgement is made to all Federal, State, county, and private agencies whose assistance and cooperation made this report possible. Special thanks are also given to entomologists D. D. Ward and J. B. Hanson for their assistance in compiling the report. Comments on the report are welcome.

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Cover photo: The forest tent caterpillar caused extensive damage to hardwood stands in the Gulf and Lake States in 1969. Photo shows close-up of nearly mature caterpillars and part of the 132,000 acres of valuable hardwood stands that were defoliated in Alabama and Louisiana.

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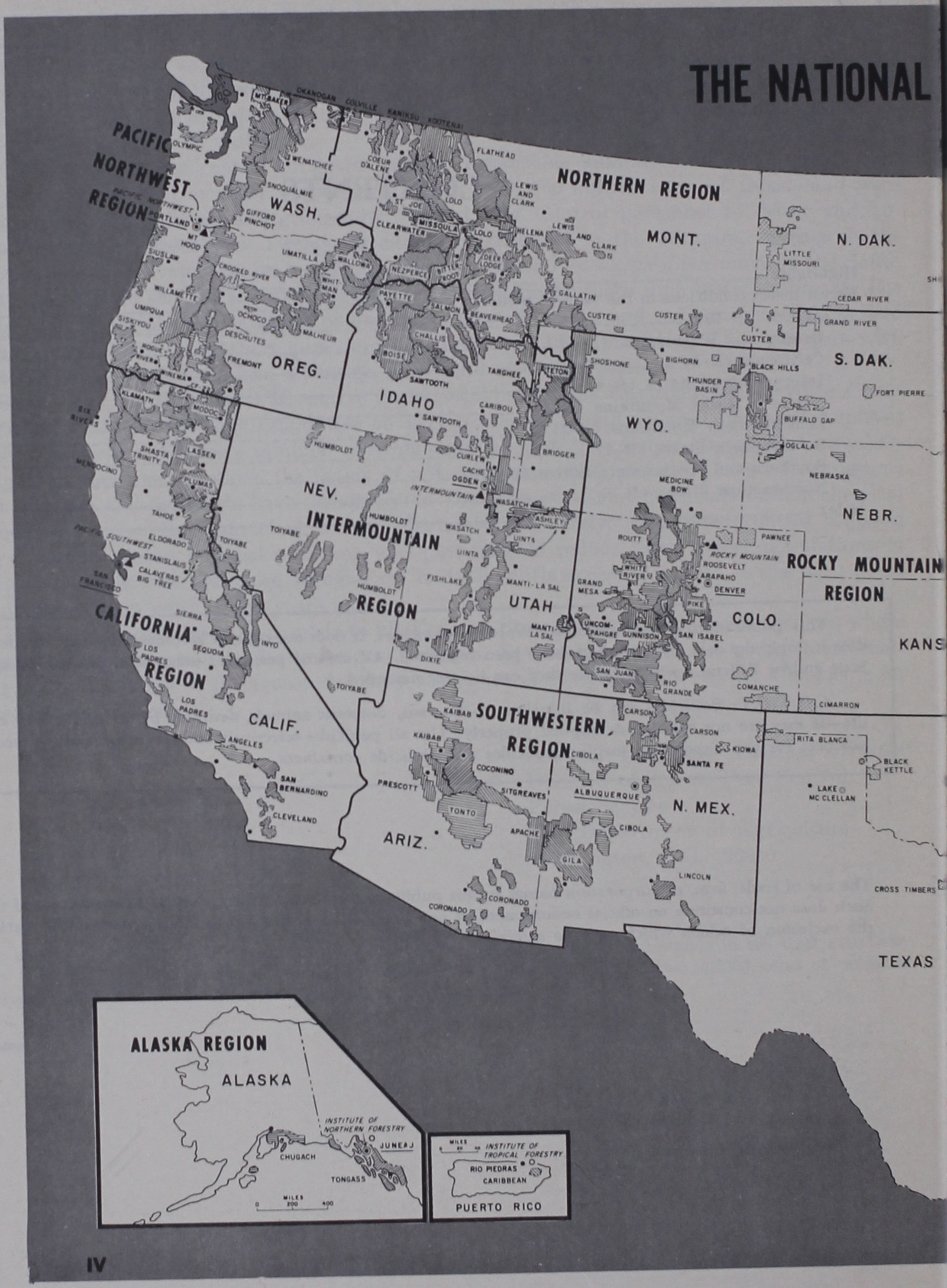
This publication reports research involving pesticides. It does not contain recommendations for their use, nor does it imply the uses discussed here have been registered. All uses of pesticides must be registered by appropriate State and/or Federal agencies before they can be recommended.

CAUTION: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife—if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

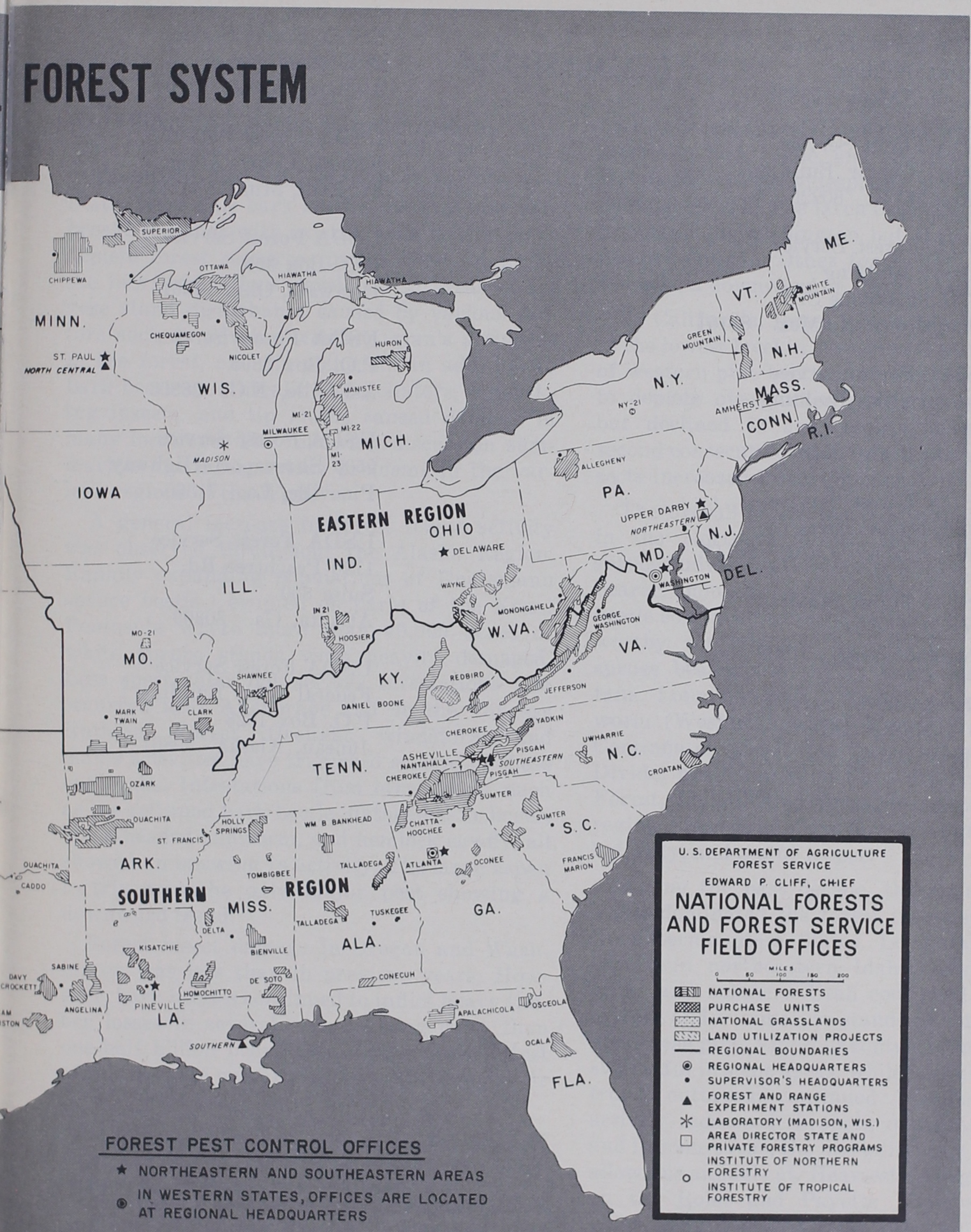
The use of trade, firm, or corporation names in this publication is for the information and convenience of the reader. Such does not constitute an official endorsement of any product or service by the U.S. Department of Agriculture to the exclusion of others which may be suitable.

Issued July 1970

THE NATIONAL



FOREST SYSTEM



FOREST PEST CONTROL OFFICES

★ NORTHEASTERN AND SOUTHEASTERN AREAS

◉ IN WESTERN STATES, OFFICES ARE LOCATED AT REGIONAL HEADQUARTERS

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

EDWARD P. CLIFF, CHIEF

NATIONAL FORESTS AND FOREST SERVICE FIELD OFFICES

MILES
0 50 100 150 200

- NATIONAL FORESTS
- PURCHASE UNITS
- NATIONAL GRASSLANDS
- LAND UTILIZATION PROJECTS
- REGIONAL BOUNDARIES
- ◉ REGIONAL HEADQUARTERS
- • SUPERVISOR'S HEADQUARTERS
- ▲ FOREST AND RANGE EXPERIMENT STATIONS
- ✳ LABORATORY (MADISON, WIS.)
- □ AREA DIRECTOR STATE AND PRIVATE FORESTRY PROGRAMS
- INSTITUTE OF NORTHERN FORESTRY
- ○ INSTITUTE OF TROPICAL FORESTRY

Forest Pest Control work is being carried on at the following locations; see map on pp. IV–V.

USDA Forest Service
Federal Building
Missoula, Mont. 59801

USDA Forest Service
Federal Center Building
Denver, Colo. 80225

USDA Forest Service
Federal Building
517 Gold Avenue S.W.
Albuquerque, N. Mex. 87101

USDA Forest Service
Federal Office Building
324 25th Street
Ogden, Utah 84401

USDA Forest Service
630 Sansome Street
San Francisco, Calif. 94111

USDA Forest Service
P.O. Box 3623
Portland, Oreg. 97208

USDA Forest Service
6816 Market Street
Upper Darby, Pa. 19082

USDA Forest Service
29 Cottage Street
Amherst, Mass. 01002

USDA Forest Service
Federal Courts Bldg.
St. Paul, Minn. 55112

USDA Forest Service
P.O. Box 365
Delaware, Ohio 43015

USDA Forest Service
P.O. Box 5895
Asheville, N.C. 28803

USDA Forest Service
2500 Shreveport Highway
Pineville, La. 71360

USDA Forest Service
1720 Peachtree Rd.
Suite 800
Atlanta, Ga. 30309

USDA Forest Service
Federal Office Building
P.O. Box 1628
Juneau, Alaska 99801

HIGHLIGHTS

Situation in the Western States

The major forest insect pests in the Western States were pine bark beetles. Several new outbreaks together with existing ones continued to deplete forest resources in the West. Many of the new infestations developed in areas of severe stand disturbance caused by various factors such as adverse weather, man's activities in the forest, and air pollution. In addition to bark beetles, outbreaks of defoliators, sapsucking insects, and tip moths caused damage in many locations. The following discussion summarizes the most serious problems in the various regions of the West.

A general increase in forest insect activity was observed throughout the Alaska Region. Rapidly expanding populations of Englemann spruce beetle [1] erupted on parts of the Kenai Peninsula where more than 40,000 acres of white spruce stands were heavily damaged. Less spectacular but serious infestations also occurred near Anchorage and on the Tongass National Forest. Drought, windstorm, and man's activities have triggered several of these outbreaks. Infestations from other pests, such as the redwood bark beetle, flatheaded fir borer, black-headed budworm, and hemlock sawfly, all showed an upswing in activity. The large aspen tortrix was the only major pest showing a downward trend.

Forest insect damage in Oregon and Washington was less than in previous years. However, bark beetles continued to inflict heavy timber losses in several areas, killing more than one-half billion board feet of sawtimber. Most of this damage was attributed to the Douglas-fir beetle, fir engraver, Engelmann spruce beetle, mountain pine beetle, and western pine beetle. Defoliators were widespread but caused little damage overall. The larch casebearer continued to spread in Washington but thus far has not reached Oregon. Other forest pest populations followed a downward or static trend.

In California, forest insect infestations were at the lowest level in several years. An outbreak of western pine beetle near McCloud continued to deplete overstocked ponderosa pine stands but declined in area and severity. For the second consecutive year, infestations of scale insects increased in various areas of the State.

The overall forest insect situation improved in the Northern Rocky Mountains but the spruce budworm (Western species)[2], larch casebearer, mountain pine beetle, and Douglas-fir beetle continued to cause serious damage. Noteworthy was the collapse of the Engelmann spruce beetle outbreak in northwestern Montana. Long-standing outbreaks of spruce budworm (Western species) decreased east of the Continental Divide but increased west of the Divide, particularly on the Nezperce National Forest, Idaho. Other forest insect pests in the region were pine engraver, fir engraver, pine butterfly, and a pine looper.

During the past decade, the mountain pine beetle dominated the forest insect situation in the Intermountain States. Long-standing outbreaks in northeastern Idaho, western Wyoming, and northern Utah continued to deplete mature and overmature stands of lodgepole and ponderosa pine. Vigorous control programs were successful in some areas, while in others, uncontrolled outbreaks continued. Douglas-fir beetle activity increased throughout southern Idaho, and in some areas, the mortality may exceed the allowable annual cut. Heaviest damage occurred on the Boise and Payette National Forests where populations have increased since 1965. A combination of natural factors and a trap-tree

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[1] *Dendroctonus rufipennis* (Kirby) has five approved common names; for simplicity, the common name Engelmann spruce beetle has been used in this report.

[2] *Choristoneura occidentalis* Freeman does not have an approved common name, therefore, in this report it is referred to as spruce budworm (western species).

program minimized an expected increase in spruce beetle activity in southeastern Idaho and western Wyoming. Natural factors also reduced western budworm populations in southern Idaho and western Wyoming.

Mountain pine beetle infestations continued to dominate the forest insect situation in the Central Rockies. Epidemic populations were present on nine National Forests as well as other Federal, State, and private lands throughout the Region. An accelerated salvage program and limited chemical control have reduced beetle populations and timber losses considerably in some areas, but most of the infestations continue uncontrolled. The Engelmann spruce beetle has become epidemic on the Medicine Bow National Forest where more than 7,000 standing trees are currently infested. Salvage logging and trap-tree programs are expected to control this outbreak. Freezing temperatures and increased parasitism were responsible for a further decline in the spruce budworm (Western species) population which is at its lowest level in 11 years.

In the Southwest, damage by the Engelmann spruce beetle continues to climb for the third consecutive year. Serious timber mortality occurred in several areas throughout the Region, especially in northern New Mexico and eastern Arizona. Mountain pine beetle and roundheaded pine beetle populations also inceased.

Situation in the Southern and Southeastern States

The southern pine beetle continues to be the principal forest pest in the South and the Southeast. A severe outbreak increased in extent and severity in the Southern Appalachian Mountains; while on the National Forests in Texas, populations subsided to an endemic level. Other infestations occurred in the Gulf South, Piedmont, and Atlantic Coastal Plains. New infestations were reported in southeastern Texas, northeastern Louisiana, and adjoining portions of Arkansas. Hurricane Camille left an abundance of beetle-susceptible material scattered over 1.9 million acres in southeastern Mississippi. Engraver beetles have already begun to build up in windthrown trees in this area. The balsam woolly aphid continued to be a problem in the Fraser-fir type in the Southern Appalachians. Mount Rogers is now the only major fir area in the Southeast free of infestation. Other important insects were the black turpentine beetle, forest tent caterpillar, Nantucket pine tip moth, fall cankerworm, and several species of pine sawflies.

Situations in the Lake Erie and Central States and the Northeast

Defoliators were the most destructive forest pests in the Eastern Region. More than 3 million acres of forest were defoliated during the past year. The gypsy moth continued to increase in extent and severity throughout New England. State and Federal agencies are extremely concerned over its southward spread into Delaware and Maryland. Spruce budworm populations have increased in northern Minnesota for the third consecutive year. An infestation in Maine threatens to cause increased tree mortality in 1970. The saddled prominent caused heavy defoliation on more than a million acres in New England. Populations of jack-pine budworm declined in the Lake States. A complex of cankerworms and loopers caused varying degrees of defoliation throughout the Northeast. One million acres of defoliation was attributed to a complex of leaf rollers and tiers. Forest tent caterpillar continued to cause heavy defoliation in Minnesota; however, a reduction in population levels was reported in Michigan, Illinois, and Vermont. New infestations were detected in Ohio, West Virginia, Pennsylvania, and Minnesota. The beech scale and its associate fungus are causing widespread destruction of commercial size beech trees in New England. Chemical control was applied to saratoga spittlebug populations in Wisconsin and Michigan. Freezing winter temperatures reduced the balsam woolly aphid population in parts of New England, but tree mortality continued in many areas. Two insecticides showed promise in controlling the pine tussock moth in Minnesota.

Suppression Activities

During 1969, land managers—Federal, State, and private—continued their cooperative effort to curb destructive forest insect outbreaks and reduce insect populations to manageable levels. More than $10 million was spent in 1969 for suppression and developing and testing new and more effective methods of survey and control.

Criteria for suppression continued to receive increased attention. At the beginning of the decade, large scale aerial spray projects involving several hundred thousand acres of forest land were quite common. Since 1963, the acreage treated by aircraft has decreased from 1.5 million acres to less than 33,000 acres in 1969. Of more importance was the discontinued use of the persistent pesticides to control defoliating insects. Most of the acreage sprayed in 1969 was for pilot-testing promising nonpersistent insecticides against the spruce budworm.

Virulent and widespread outbreaks of the mountain pine beetle continue to plague the Western States, particularly Idaho, Utah, and Wyoming. Land managers treated over 403,000 beetle infested trees in 1969 in an attempt to reduce beetle populations to manageable levels.

In the Southeast and Gulf States, Federal, State, and private agencies relied almost entirely on non-chemical methods for suppression of serious southern pine beetle infestations. Effective control was obtained in North Carolina, Texas, Louisiana, Georgia, South Carolina, and Alabama. Land managers treated over 439,000 beetle infested pines. Harvesting beetle infested trees was the primary means of control, along with piling and burning of chemically treating infestations in inaccessible areas.

Other bark beetles requiring suppression were Engelmann spruce beetle, Douglas-fir beetle, western pine beetle, roundheaded pine beetle, and several species of pine engravers. Salvage of infested timber, various silvicultural treatments, and limited use of chemicals were the primary controls used against these pests.

Major defoliators requiring control were the spruce budworm (Western species) in the Western States, spruce budworm, gypsy moth, saddled prominent, and a complex of leaf rollers and cankerworms in the Northeast. Successful control of the gypsy moth was obtained on 61,250 acres in New York and New Jersey with aerial applications of carbaryl.

Federal, State, and private agencies are working together to find more effective means of detection and suppression to limit the spread of this serious pest.

In Minnesota, 10,000 acres were aerially sprayed for control of the spruce budworm. Zectran, the non-persistent carbamate, was tested for the third consecutive year against the western budworm. Two 4,000-acre plots were sprayed with 0.15 pound of Zectran in ½ gallon of TPM carrier per acre. A C–47 aircraft was used to apply the chemical. Problems in getting the spray to the target insect caused erratic results.

Other pilot projects and insecticide tests were conducted in various sections of the country. In Washington, stabilized pyrethins were tested against the western hemlock looper. Preliminary analysis of data indicated this botanical insecticide to be effective at the rate of 0.2 pound per acre. In Wisconsin, Landrin was more effective than Gardona, Matacil, or Sevin for controlling jack-pine budworm. Sevin and Matacil provided sufficient control of the pine tussock moth in experiments by the Minnesota Department of Agriculture.

In the South, a pilot test of phorate systemic insecticide showed excellent control of Nantucket pine tip moth. Excellent control of fall cankerworm infestations was achieved in a test by the Virginia Division of Forestry with aerial applications of Gardona at the rates of one-half and one pound per acre.

There were numerous small projects in high-value recreation areas for control of pinyon needle scale, Nevada buck moth, balsam woolly aphid, tent caterpillars, and many other forest insects.

A summary of major pest control operations for 1969 is presented in the following tabulation:

Pest Control Accomplishments in the United States, 1969

Insect and location	*Trees treated*	*Acres sprayed*
Southern pine beetle—South and Southeast	439,588	-----
Black turpentine beetle—South and Southeast	18,277	-----
Mountain pine beetle—Idaho, Utah, Montana, Colorado, South Dakota, Wyoming	364,222	-----
Bark beetle [1]—California, Oregon, Washington	64,876	-----
White pine weevil—New York	308,400	-----
Balsam wooly aphid—North Carolina	43,000	-----
European pine shoot moth—Washington, Oregon	11,735	-----
Saratoga spittlebug—Wisconsin	-----	135
Leafrollers and fall cankerworm—New Jersey	-----	9,836
Spruce budworm—Idaho, Montana, Minnesota	-----	23,868
Miscellaneous—Entire United States	1,269	-----
Total	1,251,367	33,839

[1] Reported in various combinations of western pine beetle, mountain pine beetle, ips, and flathead borers, etc.

FOREST INSECT CONDITIONS IN THE VARIOUS REGIONS

ALASKA (R-10)

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Conditions in Brief

The Engelmann spruce beetle remains the most damaging forest insect in Alaska. Epidemic populations continue to kill thousands of white spruce on the Kenai National Moose Range and adjacent State and private lands on the Kenai National Peninsula. New infestations in the south-central and interior portions of the State are causing additional mortality. The infestations in the Caribou Creek and Tonsina River drainages of south-central Alaska are still active, but declining. Blowdown caused by a severe windstorm in November of 1968 provides abundant material for a potential beetle buildup in Southeast Alaska. A program of combined trap-tree and direct control has been successful in reducing beetle populations in the Granite Creek drainage on the Anchorage Ranger District. Additional direct control will be used to reduce beetle populations on a portion of this persistent infestation in 1970. Salvage logging has been recommended as an alternative wherever possible.

A sharp increase in hemlock sawfly defoliation was observed in southeastern Alaska from Frederick Sound south to Cholmondeley Sound on Prince of Wales Island. Defoliation was generally light to moderate except for one spot near Ketchikan, where extreme defoliation resulted in some mortality. Egg survey data indicate that 1970 sawfly populations will be moderate to heavy in several locations on Revillagigedo Island near Ketchikan and at McKenzie Inlet on the east side of Prince of Wales Island.

The large aspen tortrix, active over much of interior Alaska for the past 3 years, declined because of starvation and increased parasitisms This insect is expected to be near endemic levels in 1970. No projects were undertaken to control defoliating insects during the past year.

Status of Insects

Engelmann spruce beetle. *Dendroctonus rufipennis* (Kirby). Barkbeetle populations are presently at an explosive level on portions of the Kenai Peninsula. For 3 years, rapidly expanding beetle populations have developed in forest stands disturbed by petroleum exploration, highway construction, pipeline construction, and other land clearing operations. Recent drought conditions, resulting in further stress in these stands, provided the necessary catalyst for numerous minor outbreaks to erupt into a major epidemic.

This epidemic, which covers more than 40,000 acres and includes portions of all white spruce stands from Point Possession to Homer, Alaska, threatens to engulf most of the mature and overmature white spruce stands on the Kenai National Moose Range as well as adjacent State and private holdings. A combination of drought conditions, high brood densities, and an abundance of suitable host material indicates a continuation of this outbreak. No direct control is being considered at this time.

Conditions of the National Forest lands on the Kenai Peninsula are much more encourag-

ing. Many areas of chronic low level infestation on the Chugach National Forest have become endemic. Some activity continues, but no new infestations were detected. A 300-acre portion of the Granite Creek-East Fork infestation on the Anchorage Ranger District was treated this year, using both trap-tree and chemical control methods. Additional tree killing detected in stands adjacent to this treatment area indicates a need for additional control. Planned maintenance treatment in 1970 includes use of trap-trees and direct control with ethylene dibromide. Salvage logging is also being considered.

Severe drought conditions coinciding with brood emergence from land clearing debris resulted in heavy tree killing of esthetically valuable white spruce in suburban areas adjacent to Anchorage. Additional new infestations, created by similar conditions, are causing concern to homesteaders and land developers along the Matanuska River between Palmer and Eureka in south-central Alaska and near Paxson and Cantwell in the interior. Tree killing, heavy in these areas, will probably continue until suitable host material is depleted or weather conditions change. Epidemic losses in the mature and overmature white spruce stands of south-central and interior Alaska will continue to be a serious problem until landowners and managers become aware of the factors relating to buildup and are willing to accept the responsibility for implementing preventive measures.

A severe windstorm in November of 1968 blew down thousands of Sitka spruce over much of the Tongass National Forest in southeastern Alaska. This blowdown, most of which will not be logged in the immediate future, increases the potential for a serious beetle outbreak. At present, very little of the downed material has become infested. A survey conducted in portions of the wind-damaged areas detected significant broods at only two locations. A number of windthrows adjacent to two separate areas of old logging on private land near Juneau are moderately infested. Some tree killing is expected next year. However, the amount of damage incurred will depend on favorable weather conditions during the 1970 flight period. No control is being considered at this time. However, it is recommended that concentrations of windthrown spruce be logged as early as possible.

A cedar bark beetle, *Pholeosinus squamosus* Blkm. A cedar bark beetle, active throughout the range of red and yellow cedar in southeast Alaska, was especially concentrated on the South Tongass National Forest. Localized infestations, totaling several thousand acres, were observed on Kupreanof, Wrangell, Etolin, Prince of Wales, and Revillagigedo Island and along the mainland from Bradfield Canal south to Portland Inlet. Especially large concentrations of mortality were observed in the southern half of Wrangell Island, in the vicinity of Bell Arm, and along the southern arms of the Boca de Quadra. Tree killing is expected to continue in 1970.

Flatheaded fir borer, *Melanophila drummondi* Kby. Increased wood borer activity occurred in stands of western hemlock located along 2 miles of the Salmon River near Hyder, Alaska. Siltation of the river bottom, caused by periodic flooding, has resulted in a general decline of the stands in this area. A large number of weakened and recently dead hemlock contains a very high population of borers. Bark samples contained as many as 12 larvae per square foot of bark surface. Salvage logging is being used to control this outbreak.

Black-headed budworm, *Acleris variana* (Fern.) Black-headed budworm populations, low in southeastern Alaska since 1965, have increased this season. Defoliation was not observed during the aerial detection survey, but eggs have been found at many of the sampling points. Indications are that populations will generally increase south of Frederick Sound next year and that some light defoliation will occur. In the Prince William Sound area of south-central Alaska, three separate infestations, totalling approximately 29,000 acres,

were detected. These outbreaks, the first recorded in this part of Alaska, occurred on Naked Island and in the general areas of Eaglek Inlet and Eshamey and Paddy Bay. The defoliation, occurring on both spruce and hemlock, was generally light to moderate. However, localized concentrations of heavy to extreme defoliation resulted in extensive top-kill and tree mortality. The heaviest defoliation, occurring primarily on hemlock, was located on the isthmus between Squaw and Derickson Bay in Eaglek Inlet and along the headlands between Paddy Point and Granite Bay in the Eshamey and Paddy Bay area. Pupae collections and egg sample data indicate heavy larva populations in these same areas next year. Many areas with little or no observable defoliation contained very high egg counts, indicating that budworm populations are increasing. Extensive top-killing and some concentrated tree mortality is expected over several thousand acres in 1970.

No control is planned for this outbreak. The stands within these infestations are, for the most part, either classified as noncommercial or are located within the boundaries of a proposed wilderness area.

A saddleback looper, *Ectropis crepuscularia* (Denis and Schiffermuller). The first recorded outbreak of this looper occurred over 200 acres of western hemlock near Ketchikan. One season of feeding produced extreme defoliation and some tree mortality. The hemlock sawfly, found in association with the saddleback looper throughout the infestation center, caused additional light to moderate defoliation in adjacent areas. The combined size of these overlapping infestations is estimated at 500 acres. Insect pathogens, diagnosed by the Forestry Sciences Laboratory at Corvallis, Oreg. as a combination of polyhedral virus and gram negative bacterium, are believed to be responsible for a reduction in late larval populations. Results of a pupae survey revealed that overwintering populations are relatively low throughout the outbreak area. Egg sample data indicate that a moderate to heavy population of sawflies will occur in this same area next year. Combined looper and sawfly defoliation is expected to result in additional tree killing. A "standby" control operation is being considered for this infestation.

Hemlock sawfly, *Neodiprion tsugae* Midd. A sharp increase in hemlock sawfly defoliation was observed in several areas south of Frederick Sound on the Tongass National Forest. Light to moderate defoliation was observed on Wrangell, Etolin, Revillagigedo, and Prince of Wales Island, and on portions of the Cleveland Peninsula. Extreme defoliation resulted in tree killing over 120 acres on Revillagigedo Island near Ketchikan. Egg survey data indicate that 1970 sawfly populations will be moderate to heavy in several locations on Revillagigedo Island near Ketchikan and at McKenzie Inlet on the east side of Prince of Wales Island. No control is being considered in 1970.

Large aspen tortrix, *Choristoneura conflictana* (Wlk.) Populations declined in the Tanana Valley as anticipated. Seasonal damage, consisting of scattered light defoliation, was significantly less than in 1968. Complete defoliation occurred for the third consecutive year from Glenallen south to the Chitna cutoff, and as far east as Chicken, north of Tetlin Junction on the Alaska Highway. Widespread starvation of late instar larvae and an increase of parasitism in these areas indicate that a significant reduction in population is occurring. If the insect follows the "normal" pattern, it will decline next year. No control programs are being considered.

Unknown bud moth. Populations of a bud moth tentatively identified as a species of *Zeiraphera,* in white spruce stands on the Anchorage and Kenai Ranger Districts in 1968, have declined. Larva were present in small numbers at collection sites, but bud damage and discoloration were not generally observed. Populations are expected to remain at endemic levels in 1970.

Cottonwood leaf beetle, *Chrysomela scripta* F. Defoliation of black cottonwood and associated hardwood species was observed on portions of river bottom stands from Port Snettisham to Haines. The heaviest defoliation occurred on 200 acres at the north end of Berners Bay. The trend of these infestations was not determined. No control is being considered in 1970.

OREGON AND WASHINGTON (R-6)

By Leon F. Pettinger and Robert E. Dolph
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Conditions in Brief

Outbreaks of forest insects were generally lower in Oregon and Washington during 1969. Bark beetles were the most destructive. Epidemic outbreaks occurred on 990,100 acres with an estimated volume of 547,505,850 board feet of sawtimber killed. The Douglas-fir beetle, fir engraver, and mountain pine beetle were the most destructive bark beetles.

Defoliators caused few serious problems in Oregon and Washington. Needle miners on lodgepole and ponderosa pines and the western hemlock looper populations are declining. A larch bud moth and larch casebearer caused light defoliation over vast areas in eastern Washington.

Status of Insects

Larch casebearer, *Coleophora laricella* (Hbn.) Since first discovered near Spokane, Wash. in 1960, the casebearer has spread to all larch stands in Spokane, Pend Oreille, Stevens, and Ferry Counties. In addition, many of the larch stands in eastern Okanogan County are also infested. The casebearer has not been found in Oregon, although it has been present for the last 3 years within a few miles of the State line in Asotin and Garfield Counties in southeastern Washington.

The parasite, *Agathis pumila* (Ratz), was released at six sites on the Okanogan National Forest. Parasites have been released at 30 sites in northeastern Washington since 1966. Establishment and spread of the parasite, as determined by surveys, has not been as successful as had been originally hoped for.

Western hemlock looper, *Lambdina fiscellaria lugubrosa* (Hulst). Outbreaks on the Mt. Baker National Forest in Washington continued, but at a much lower intensity and extent than last year. Late summer surveys showed that over 50 percent of the larvae were parasitized by a tachinid fly.

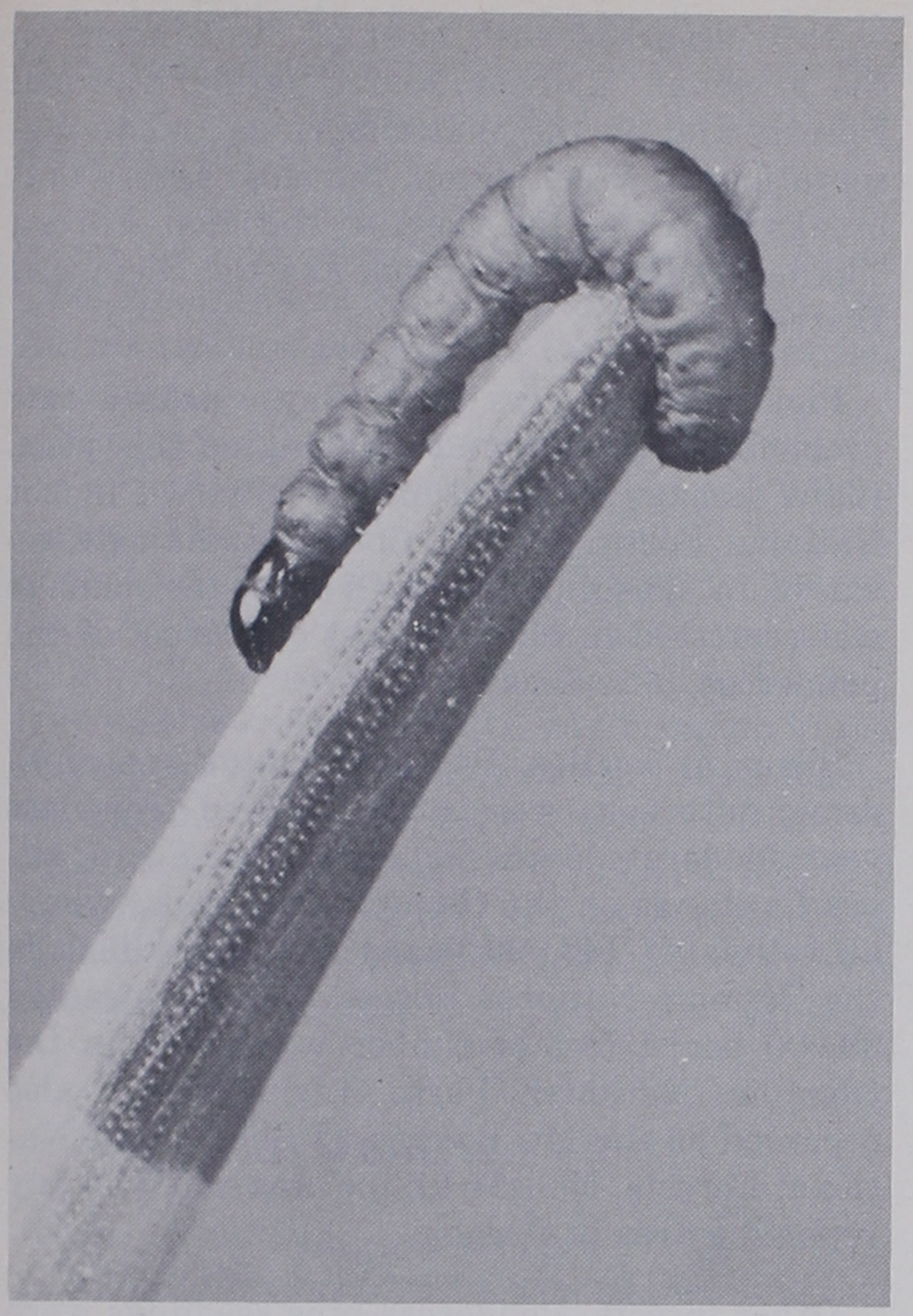
During July, cooperatively with the Kenya Pyrethrum Company and the Pacific Northwest Forest and Range Experiment Station, stabilized pyrethrins were tested against the looper on 145 acres in the upper Cascade River drainage. Pyrethrins were applied at the rate of 0.2 pounds per acre by helicopter. Early analysis of data shows that stabilized pyrethrins may be a suitable means of controlling hemlock looper. Larval counts before and after spraying on understory trees and shrubs showed a 63 percent population reduction in the sprayed area, while in an unsprayed check area, the populations on the understory vegetation increased by 12 percent.

A needle miner *Coleotechnites sp.,* near *milleri,* continued to defoliate lodgepole pine in the upper Deschutes and Klamath Basins in central Oregon. There has been a significant reduction in extent and intensity of the outbreak during the past year, and populations are expected to continue declining next year. The population damaging ponderosa pine on the Deschutes and Winema National Forests for the past 3 years has dropped to below epidemic levels.

European pine shoot moth, *Rhyacionia buoliana* (Schiff.) No new infestations were found in Oregon outside the known infested communities of Portland, McNary Dam, Umatilla, and Hermiston. A shipment of ornamental pines containing infested material from Washington was intercepted at Milton-Freewater, Oreg. and destroyed. In Washington, new infestations were found at Vancouver and Centralia. Infested trees found outside the known infestation zones in Portland were sprayed and/or destroyed to control the moth. At College Place, Wash., infested ornamental pines were destroyed.

A Larch bud moth, *Zeiraphera griseana* (Hbn.), defoliated larch stands on the Snoqualmie and Wenatchee National Forests in Washington for a second year. Infested acreage remained little changed on the Wenatchee National Forest, but increased substantially on the Snoqualmie.

Balsam woolly aphid, *Adelges piceae* Ratz,



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Larva of *Coleotechnites* near *milleri*. The dark portion of the needle was mined by the larva.

caused widespread losses in true fir stands throughout the Cascade Mountain Range in Oregon and Washington. Overall losses were only slightly less than last year. The aphid was discovered for the first time on the Olympic Peninsula northwest of Hoodsport, Wash. The known infestation zone is small, but will probably spread rapidly. Tree mortality has occurred to the alpine fir; Pacific silver fir, so far, has only suffered light top killing. Elsewhere in Washington, most of the damage occurred on the Snoqualmie and Gifford Pinchot National Forests. In Oregon, those reporting areas receiving the most damage were the Deschutes, Mt. Hood, Umpqua, and Willamette National Forests.

Spruce aphid, *Elatobium abietinum* (Wlk.), caused moderate defoliation of Sitka spruce along the southwest Washington Coast. The damage was not widespread and no tree mortality is expected.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Over 121 million board feet of timber on 115,440 acres was killed in Oregon and Washington in 1969. The volume was divided about equally between eastside and westside Douglas-fir types. In Washington, most of the damage occurring west of the Cascade Mountains was in the Wind River and Lewis River drainages on the Gifford Pinchot National Forest, where 48 million board feet of mortality occurred on 29,000 acres. Lesser amounts of tree mortality occurred on the Mt. Baker National Forest and in Olympic National Park. In eastern Washington, most of the damage was on the Okanogan and Colville National Forests, where the losses totaled 3 million and 13 million board feet, respectively. Outbreaks declined in western Oregon. Nearly all of the 3 million board feet of timber killed was found on the Mt. Hood, Rogue River, and Umpqua National Forests.

In eastern Oregon, the beetle has increased its activity. An estimated 6 million board feet of timber was killed primarily on the Wallowa-Whitman and Umatilla National Forests.

Fir engraver, *Scolytus ventralis* LeC. Widespread tree mortality was recorded in many true fir stands in eastern Oregon and Washington. Results of the 1969 aerial survey showed the fir engraver was active on 358,000 acres. In Oregon, over 78 million board feet of timber was killed. Hardest hit were the Wallowa-Whitman and the Umatilla National Forests. The Malheur, Rogue River, Ochoco, and Winema National Forests also suffered significant losses. In Washington, where 9 million board feet of timber was killed, most of the damage was on the Wenatchee and Colville National Forests and Northeast Washington District.

Engelmann spruce beetle, *Dendroctonus rufipennis* (Kirby). Damage increased greatly in Washington, but decreased in Oregon. In Washington, over 20 million board feet of timber was killed on 24,000 acres. Hardest hit areas were found on the Colville, Kaniksu, and Okanogan

National Forests and the Colville Indian Reservation. In Oregon, an estimated 540,000 board feet of timber was killed. The heaviest concentrations of this bark beetle occurred on the Wallowa-Whitman National Forest.

Mountain pine beetle, *Dendroctonus ponderosae* Hopk. Timber losses attributed to this bark beetle were about the same as last year. Damage to western white pine stands in the Cascade Mountains increased slightly in both Oregon and Washington. Losses decreased on the Olympic Peninsula in Washington. In Oregon, an estimated 205 million board feet of timber was killed, most of it occurring on the Willamette, Umpqua, and Mt. Hood National Forests. Most of the 31 million board foot loss in Washington was concentrated on the Snoqualmie and Wenatchee National Forests.

Regionwide, the total infested acreage in pole-size ponderosa pine stands decreased. Outbreaks in Oregon were widely scattered with a volume loss of 4 million board feet on 55,000 acres. Most of the infestations were on the Deschutes, Fremont, Wallowa-Whitman, and Winema National Forests. The damage was more concentrated in Washington where an estimated 6 million board feet of timber was killed on 12,000 acres. Losses were most severe on the Snoqualmie, Okanogan, and Wenatchee National Forests and on the Yakima Indian Reservation.

Infestations in lodgepole pine decreased in the Region. In Washington, outbreaks occurred on less than 2,000 acres. Volume estimates of losses were under 2 million board feet. The damage was centered on the Colville and Okanogan National Forests and the Colville and Spokane Indian Reservations. Epidemic losses of lodgepole in Oregon occurred on some 184,000 acres with a volume loss of nearly 5 million board feet. Reporting areas suffering the most damage were the Deschutes, Fremont, Winema, and Wallowa-Whitman National Forests.

Western pine beetle, *Dendroctonous brevicomis* LeC. Epidemic outbreaks in mature ponderosa pine stands were lower throughout the Region. The aerial detection survey revealed a volume loss of almost 19 million board feet in Oregon and Washington. Outbreaks in Oregon were widespread with most of the damage on the Fremont, Malheur, and Umatilla National Forests and on the Warm Springs Indian Reservation. In Washington, the most severe outbreaks were on the Colville National Forest, Yakima Indian Reservation, and the Glenwood District.

Pine engraver, *Ips pini* (Say), caused few problems in Oregon and Washington this year. Light damage occurred on the Gifford Pinchot National Forest and the Colville Indian Reservation in Washington. In Oregon, the damage was scattered in small patches over most of the ponderosa pine areas.

Silver fir beetles, *Pseudohylesinus* spp. Epidemic outbreaks were little changed from last year. Moderate losses occurred in the Pacific silver fir stands on the Olympic Peninsula, where an estimated 147,000 board feet was killed on the Olympic National Forest and an estimated 39,000 board feet of timber was killed in the Olympic National Park. Light losses also occurred on the Mt. Baker and Snoqualmie National Forests. No tree killing was noted on any reporting area in Oregon.

Other insects. Ponderosa pine seedlings were defoliated by grasshoppers at several localities in the Region. The most numerous species included the migratory grasshopper, *Melanoplus sanguinipes* (F.), clear-winged grasshopper, *Camnula pellucida* (Scudd.), and *Cratypedes neglectus* (Thomas). On a privately-owned plantation near Klickitat, Wash., the damage was severe enough to require control. Similar damage occurred on the Colville Indian Reservation in Washington, but was not controlled. In Oregon, grasshoppers caused light defoliation on a pine plantation on the Applegate District, Rouge River National Forest.

A complex of ponderosa pine terminal feeders has been tentatively identified as a gouty pitch midge, *Cecidomyia piniinopis* (O.S.); a ponderosa pine tip moth, *Rhyacionia zozana* (Kearf.); and an unidentified pine weevil. This group of insects caused heavy damage in a 10-year-old ponderosa pine plantation near Keno, Oreg. Damage is expected to be significant in many areas in southern Oregon next year.

A scolytid beetle, *Dryocoetes* sp., caused light to moderate tree killing in true fir stands on the Sullivan Lake District of the Colville National Forest in Washington.

Low populations of the black-headed budworm, *Acleris variana* (Fern.), lightly defoliated true firs and Engelmann spruce near Mt. Adams Lake on the Yakima Indian Reservation in Washington.

Tent caterpillars and webworms were numerous on hardwoods in western Oregon and Washington. The western tent caterpillar, *Malacosoma californicum pluviale* (Dyar), caused light to heavy defoliation in many red alder stands in northwest Oregon. The fall webworm, *Hyphantria cunea* (Drury), was common in the Willamette Valley in Oregon, southwest Washington, and along the lower Columbia River in both States. The unsightly tents and webbing on ornamental, roadside, and park trees were the chief concern with these insects. Defoliation caused no tree mortality or permanent damage.

CALIFORNIA (R-5)

By John R. Pierce
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Conditions in Brief

Insect pests killed fewer trees in California forests in 1969 than in any other recent year. Bark beetle outbreaks accounted for most insect caused tree mortality but were fewer and confined to more limited areas. An increase in scale infestations, first noted last year, persisted in 1969 and the physiological condition of forest trees in several areas of the State has been considerably impaired. Grasshoppers continued to cause severe damage in newly established plantations at two locations in Siskiyou County.

Status of Insects

Western pine beetle, *Dendroctonus brevicomis* LeC. The epidemic of western pine beetle in young-growth ponderosa pine continued at McCloud Flats, Siskiyou County in 1969. Although this outbreak is persisting, a decline in area and intensity was noted during the year. Direct control measures were applied by logging infested trees in the fall of 1968 and the spring of 1969. This project removed about 7,200 infested trees or 2.5 million board feet of infested material and successfully curtailed the epidemic. Commercial thinning has been prescribed to reduce stand stocking and reduce the potential for future outbreaks in the area.

Chronic western pine beetle infestations continued at Basket Pass and Bradshaw Creek in Kern County and Plaskett Ridge in Monterey County. A new outbreak developed in a local area near Bass Lake in Madera County. Direct control is planned for all of these areas except Basket Pass. Scattered infestations detected early in 1969 in the Cosumnes River area, El Dorado County, and in the Yuba River drainage, Yuba County, subsided; while in late summer, outbreaks developed at Cedar Ridge and Thirteen Mile Creek in Tuolumne County. Evaluations indicate control for the last two areas is not needed at this time.

In southern California, western pine beetle activity increased around Lake Arrowhead and Barton Flats, San Bernardino County. The beetle activity was associated with air pollution damage. Beetle activity declined at Julian, San Diego County.

Fir engraver, *Scolytus ventralis* LeC. Scattered infestations of the fir engraver beetle in northern California subsided during the past year. Seventy trees weakened by annosus root rot, *Fomes annosus* (Fr.) Cke., were killed by the beetle in Camp Richardson at Lake Tahoe. At Eight Mile Ridge, Trinity County, and Buck Mountain, Humboldt County, late fall ground checks showed nearly complete collapse of the engraver infestations.

Other bark inhabiting insects. Damage by other bark beetles has declined to a low level. Although pine engravers, *Ips* spp., killed patches of knobcone pine in Siskiyou and Shasta Counties, damage to commercial tree species was negligible. Only five localized infestations of *Dendroctonus ponderosae* Hopk. were reported during the year. The reports were from Mono, Tulare, Fresno, and Shasta Counties.

The California flatheaded borer, *Melanophila californica* Van Dyke, showed increased activity in the Laguna Mountains of San Diego County, and at Wrightwood, San Barnardino County.

In numerous locations in northern California, oak twigs have been damaged and killed by heavy infestations of a cynipid wasp, probably *Callirhytis perdens* Kins.

Sapsucking insects. The outbreak of pine needle scale, *Phenacaspis pinifoliae* (Fitch) continued in the community of South Lake Tahoe, El Dorado County. The strategy for dealing with this problem will be to conserve and increase natural enemies of the scale. This is to be accomplished by changing the present mosquito control program from a fogging treatment with malathion, detrimental to the natural enemies of the scale, to a source abatement program employing larvacides in mosquito breeding sites along with the introduction of mosquito-eating fish.

The pinyon needle scale, *Matsucoccus acalyptus* Herb., is epidemic over some 22,000 acres of the arid pinyon type in Ventura and Kern Counties in southern California. Some tree killing has taken place; operational spraying of individual recreation sites to prevent further tree killing is under consideration for 1970.

F–519871

The damaged sugar pine on the right is shown in comparison to a more healthy neighboring tree. The dieback was caused by the scale *Matsucoccus acalyptus* Herb.

An infestation by a needle scale, also identified as *M. acalyptus,* has persisted into the fourth year and is severely weakening sugar pine in Siskiyou County in northern California. Heavy populations of the black pine leaf scale, *Nuculaspis californica* (Coleman), on sugar pine were found near Long Barn, Tuolumne County, and on ponderosa and Jeffrey pine near Burney, Shasta County. In addition to these damaging infestations, widespread endemic scale populations exist in several other localities.

Defoliating insects. Defoliating insects caused noticeable damage on hardwood trees and shrubs in 1969. The California oakworm, *Phryganidia californica* Pack., defoliated thousands of oaks in highway scenic areas from King City, Kings County, to Salinas, Monterey County. Improved preparations of *Bacillus thuringiensis* (Berliner) were tested by University of California entomologists and proved very effective for controlling this insect. The unsightly webs of the fall webworm, *Hyphantria cunea* (Drury), on madrone and occasionally alder, were reported from Yuba, Shasta, and Monterey Counties. The brown day moth, *Pseudohazis eglanterina* (Bdv.), defoliated bitterbush on about 1,000 acres near Indiana Summit, Mono County. The elm leaf beetle, *Galerucella zanthomelaina* (Schrank), and the alder flea beetle, *Altica ambiens* LeC., damaged elm and alder in various locations.

None of the conifer defoliators caused serious damage in 1969. However, detailed field sampling of the lodgepole needle miner, *Coleotechnites milleri* (Busck), in Yosemite Park, showed significant increase in numbers of larvae this year. If unchecked, this resurgent population is expected to cause serious defoliation in 1971. In southern California, the persistent infestation of *Coleotechnites* sp. in Jeffrey pine at Snow Valley, San Bernardino County, showed some decrease in population.

The Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD., was detected in small numbers again at Wilcox Springs and Latour State Forest, Shasta County, and a few larvae were detected for the first time at Redwood Mountain, Fresno County. Spot infestations of the balsam fir sawfly, *Neodiprion abietis* (Harr.), complex reported from Swain Mountain and Diamond Mountain, Plumas County, were the first indications of renewed activity of this defoliator since 1966. A pandora moth, *Coloradia lindsaeyi* B&B, caused light defoliation of Jeffrey pine at Rattlesnake Meadow, Kern County.

Insects damaging plantations and young trees. For the second year, grasshoppers invaded newly planted plantations near Mt. Shasta City, and also struck 30 miles northeast of there in plantations near Doe Park, Siskiyou County. Both infestations were succesfully controlled by the Agricultural Research Service. The principal damaging grasshopper was the wingless species, *Bradynotes abesa opima* Scudder. This species also required control in 1968.

A Douglas-fir bud mite, *Trisetacus pseudotsugae* Keifer, was discovered for the first time in California in nursery stock near Half Moon Bay, San Mateo County, through nursery inspection by the County Agricultural Commission. The California Bureau of Entomology also located the mite in nearby natural Douglas-fir stands and concluded it is a native organism probably confined to coastal areas. Therefore, control or eradication action is not planned.

Valuable grafted seed orchard stock has suffered frequent attacks by a variety of insects near Placerville, El Dorado County. The pine needle-sheath miner, *Zelleria haimbachi* Busck; a shoot moth, *Eucosma* sp.; and the pitch midge, *Cecidomyia piniiopis* (O.S.)., were active this year and were suppressed with dimethoate sprays. Also at the Placerville Nursery, the black cutworm, *Agrotis ipsilon* (Hufnagel), damaged seedbeds and was suppressed with an application of Sevin dust.

Light, but widespread, infestations of Douglas-fir gall midges, *Contarinia* spp., were discovered in the counties of Mendocino, Humboldt, and Del Norte.

INTERMOUNTAIN STATES (R-4)[3]

By William H. Klein and Douglas L. Parker
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Conditions in Brief

The most damaging forest insect problem in the Intermountain Region remains the mountain pine beetle in lodgepole pine. Vigorous control efforts have slowed the beetle's movement in one area on the Targhee National Forest, but in other areas and in adjoining Yellowstone National Park, serious tree killing persists. A resurgence of beetle activity is occurring in portions of Grand Teton National Park, while in adjacent Teton National Forest, beetle populations and subsequent tree killing remain at a relatively low level. Lodgepole pine mortality continues at a high level with no letup expected along the western edge of the Bridger Wilderness. Small, rather localized buildups were noted in portions of southern Idaho and on the Wasatch National Forest in Utah. Elsewhere, beetle populations were static or decreasing. Killing of ponderosa pine by this bark beetle remained at approximately the same level as last year.

Populations of Douglas-fir beetles are increasing in old growth Douglas-fir throughout southern Idaho. Serious tree killing has occurred on the Boise and Payette National Forests. Logging is being encouraged, but its only immediate benefit is salvage.

Salvage logging will help utilize dead and dying Engelmann spruce attacked by the Engelmann spruce beetle on the Fishlake National Forest in Utah. A threat to standing spruce was averted by an effective trap-tree program on the Payette Forest.

The heavy populations of spruce budworm (Western species) forecast for many Douglas-fir-true fir stands in southern Idaho and western Wyoming did not materialize. Light to moderate defoliation is anticipated for these same areas in 1970. Light populations of the budworm on white fir were detected for the first time in Bryce Canyon National Park.

[3] Includes forested lands in Utah, southern Idaho, western Wyoming, and Nevada.

Status of Insects

Mountain pine beetle, *Dentroctonus* ponderosae Hopk., continues to plague the pine forests of the Intermountain West. On the Targhee National Forest, intensive control efforts have momentarily lessened the impact of the beetle in a large area proposed for a 150 million board feet timber sale, but elsewhere on the Forest and in neighboring Yellowstone Park, tree killing continues at an alarming rate. To the east, in Grand Teton Park, a resurgence in tree killing continues for the second straight year, while on adjacent Teton National Forest and BLM land, beetle populations continue to decline.

On the Bridger National Forest, Bridger Division, the already serious infestation extended eastward into beetle-free stands along the Bridger Wilderness boundary. This infestation is beyond control, and the only hope now is to move in front of it and log the doomed stands in an orderly manner. In the Wyoming Division, conditions vary. Tree killing declined in the Lower Greys River but increased in the upper part and in the Little Greys drainage. Widely scattered infestations, although decreasing, continue to cause the decline of other lodgepole stands in southern Idaho and northern Utah. A slight increase in red tops occurred in the upper reaches of the Bear River, Wasatch Forest, Utah.

Ponderosa pine stands continue to be attacked by the mountain pine beetle in widely separated areas in southern Idaho and Utah. The chronic infestation on State and private lands near Cascade, Idaho, remained at a high level for the fifth consecutive year, while the more recent outbreak in Flaming Gorge National Recreation Area, Ashley National Forest, Utah, shows signs of abating. As many trees were killed this year as last in Bryce Canyon National Park and Dixie National Forest.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk., increased to an alarming level throughout southern Idaho, with extreme conditions existing in portions of the Boise and Payette National Forests. In some areas, mortality may actually exceed the allowable annual cut. The widely scattered groups of dead and dying trees

make control unfeasible, but salvage logging is underway in some areas. The only hope for control now is the intervention of natural factors. Elsewhere, in western Wyoming and Utah, the beetle remained at a low level.

Engelmann spruce beetle, *Dendroctonus rufipennis* (Kirby). Natural factors offset a supposed increasing trend by reducing beetle populations in high-elevation spruce stands in portions of southeastern Idaho and western Wyoming. A trap-tree program aided by natural factors averted standing tree attacks in a logging area on the Payette Forest, Idaho. Some dead and dying spruce in the Hilgard Mountain infestation, Fishlake National Forest, Utah, will be salvaged by logging.

Spruce budworm (western species) *Choristoneura occidentalis* Free. The anticipated increase in spruce budworm damage in parts of southern Idaho and western Wyoming failed to materialize. Unknown natural factors reduced populations to a level well under those expected. Some heavy feeding occurred on the Payette National Forest, but in all other major infesta-

F–519869

Larva of *Pissodes* sp. feeding in terminal leader of lodgepole pine.

F-519870

Repeated defoliation by the sugar pine tortirx causes multiple killing of terminal shoots on lodgepole pine.

tions, damage was medium to light with little or no change in infestation boundaries. This moderate trend should continue in 1970. Budworm populations on white fir, *Abies concolor,* were detected for the first time in Bryce Canyon National Park in southern Utah.

Engraver beetles, *Ips* spp., continue to kill second-growth ponderosa pine in some areas on the Boise and Payette Forests, but considerably under the high level of the past 3 years. Lindane treatment of infested slash prevented a potential outbreak on the Emmett Ranger District, Boise Forest.

Sugar pine tortrix, *Choristoneura lambertiana* (Busck.), populations continue to fluctuate in mature lodgepole pine stands throughout southeastern Idaho and western Wyoming. Light but extensive activity was evident along the lower west slope of the Grand Teton Range, Targhee National Forest. Repeated defoliation has caused top kill and forking in some areas in Grand Teton National Park and Teton National Forest.

A weevil, *Pissodes* sp. Intensified management practices and the creation of lodgepole pine regeneration areas and plantations increase the damage potential from this and other reproduction insects. Heavy tip damage to lodgepole reproduction continues near Alturas Lake, Sawtooth National Forest, Idaho, with lighter damage occurring in some reproduction areas on the Targhee National Forest, Idaho, and the Bridger National Forest, Wyo.

Tent caterpillars, *Malacosoma spp.,* caused light defoliation of some shade trees and range plants in southern Utah. A southwestern tent caterpillar, *M. incurvum* (Hyman Edwards), on Freemont cottonwood was controlled by mistblower application of *Bacillus thuringiensis* (Berliner) in campgrounds in Zion National Park. Damage to bitterbrush by the California tent caterpillar, *M. californicum* (Packard), decreased in intensity and extent.

Other insects. Extensive areas of Gambel oak along the Wasatch Front, Utah, were heavily defoliated for the second straight year by a looper, *Lambdina punctata* (Hulst). *Dioryctria* sp., in association with a terminal weevil, *Pissodes* sp., destroyed new lodgepole pine buds in some reproduction areas on the Targhee National Forest. Fir engraver, *Scolytus ventralis* LeC., and western balsam bark beetle, *Dryocoetes confusus* Sw., caused both primary and secondary damage to subalpine fir throughout its range. A tent building defoliator, possibly the fall webworm, *Hyphantria cunea* (Drury), caused localized heavy defoliation of narrowleaf cottonwood along the Sevier River in southern Utah. *Ceanothus* sp. and ponderosa pine were lightly defoliated by an omniverous tussock moth, *Hemerocampa* sp., in the Town Creek Plantation, Boise Forest, Idaho. A resurgence of pine butterfly, *Neophasia menapia* (Felder & Felder), may be in the offing in remote areas in southern Idaho. Western pine beetle, *Dendroctonus brevicomis* LeC., was present, but at a low level in several areas on the Dixie National Forest, Utah. Populations of the white fir needle miner, *Epinotia meritana* Hein., and a needle tier, *Argyrotaenia dorsalana* (Dyar), caused only light damage to white fir in Bruce Park and Dixie Forest, Utah. Aggressive populations of the roundheaded pine beetle, *Dendroctonus adjunctus* Blandf., continued to kill ponderosa pine in recreation areas on the Toiyabe National Forest near Las Vegas, Nev. Control is being undertaken for the second straight year by removing the beetle-infested trees.

NORTHERN ROCKY MOUNTAINS [4] (R-1)

By Frederick W. Honing
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Conditions in Brief

Generally, insect populations were at low levels in the Northern Region during 1969. Severe cold temperatures and predators and parasites reduced Engelmann spruce beetle populations to low levels in the North Fork Flathead River, Flathead National Forest, Mont. Spruce budworm (Western species) infestations rang-

[4] Includes forested lands in Montana, northeastern Washington, northern Idaho, North Dakota, northwestern South Dakota, and National Park Service land in northern Wyoming.

ing from light to very heavy occurred on more than 4.1 million acres in Idaho and Montana. Defoliation continued to decrease east of the Continental Divide in Montana and increase west of the Divide. Larch casebearers spread into the Bob Marshall Wilderness Area which is the eastern limit of western larch type. One native parasite caused 50 percent reduction of casebearer population at one site in Montana. Tree killing by mountain pine beetle increased in northern Idaho and decreased in eastern Montana. The Douglas-fir beetle killed large volumes of Douglas-fir in eastern Washington, northern Idaho, and Montana. Tree killing by fir and pine engravers decreased in most areas of the Region. A pine looper caused severe defoliation of ponderosa pine near Lame Deer and Ashland, Mont.

Status of Insects

Engelmann spruce beetle, *Dendroctonus rufipennis* (Kirby). Extreme spruce bark beetle tree killing observed in the North Fork of the Flathead River, Flathead National Forest, Mont. during the past 2 years has subsided due to natural factors. Extremely cold temperatures, predators, and parasites reduced the population from over 200 to 5 beetles per square foot of bark surface.

Tree killing was observed in Sullivan Creek drainage, Colville National Forest, Wash.; Granite and Hughes Creeks, Kaniksu National Forest, Idaho; and throughout the South and Middle Forks of the Flathead River, and the Stillwater drainage in Montana. Approximately 400 trees were killed west of St. Maries Lake, Glacier National Park. Tree losses are expected to be low next year.

Approximately 150 windthrown infested spruce were treated with ethylene dibromide in the proposed Jewel Basin Scenic Area, Flathead National Forest. Cost of treatment averaged $45 per tree.

Other than logging infested and susceptible mature and overmature spruce trees, no control is planned for 1970.

Spruce budworm (western species), *Choristoneura occidentalis* Free. The net average of infestations in the Northern Region is approximately 4.1 million acres. Although intensity of defoliation decreased in most areas, very heavy defoliation occurred on about 300,000 acres of mixed fir and spruce on the Nezperce National Forest, Idaho. This infestation has increased steadily in scope and severity each year since 1964. Considerable grand fir top kill and reproduction mortality was observed in the South Fork Clearwater River near Elk City, Idaho.

Defoliation increased from 2,000 to 15,500 acres on the St. Joe National Forest, Idaho. Budworm populations east of the Continental Divide in Montana remained at low levels during 1969. Defoliation is expected to continue at about the same level in all areas through next year.

Two, 4,000-acre infested plots of mixed fir and spruce were sprayed with Zectran by C–47 aircraft to pilot test spray application methods and techniques. One plot was sprayed with 0.15 pound Zectran in ½ gallon Dowanol (TPM—tripropylene glycol methyl ether) carrier per acre; the other plot was sprayed with two applications of 0.075 pound in ½ gallon TPM carrier per acre on 2 consecutive days.

Budworm mortality measured on four tree species—grand fir, Douglas-fir, subalpine fir, and spruce—averaged about 66 percent.

Extensive frost damage throughout Montana caused difficulty in aerial mapping of budworm-infested areas.

Larch casebearer, *Coleophora laricella* (Hbn.). Casebearer populations spread east into the Bob Marshall Wilderness Area—the eastern limit of western larch type—during 1969. Tree mortality and branch dieback occurred in widespread patches throughout the larch type defoliated 4 or more consecutive years. Most severe damage occurred on the St. Joe and Coeur d'Alene National Forests, Idaho.

About 500,000 casebearer parasites, *Agathis pumila* (Ratz.), were released in 100 casebearer-infested areas in Washington, Idaho, and Montana. Approximately 50,000 parasites were shipped to British Columbia. This parasite has been recovered from 40 percent of the release sites sampled. Five species of native parasites have been recovered. One native parasite, *Dicladocerus* sp., accounted for 50 percent parasitism in one plot.

F–519866

Repeated defoliation of young western larch by larch casebearer causes branch dieback and epicormic branching.

F–519874

Heavily mistletoed Douglas-firs such as these were easy prey for the Douglas-fir beetle.

Mountain pine beetle, *Dendroctonus ponderosae* Hopk., killed approximately 100 million board feet of western white pine on about 5,000 acres in Lightning Creek, Kaniksu National Forest, Idaho. About 1,000 acres of mixed lodgepole and ponderosa pine on State, private, and Lolo National Forest land near St. Regis, Mont., are very heavily infested. Logging-for-control is planned for both areas during 1970. Endemic infestations are present in ponderosa pine in the Big and Little Snowy Mountains, on BLM lands, and on the Lewis and Clark National Forest near Lewistown, Mont.

About 400 infested ponderosa pine were sprayed with ethylene dibromide to clean up an infestation on Monarch Mountain, Belt Creek Ranger District, Lewis and Clark National Forest. Infestations in lodgepole pine continue to decline on the Yaak District, Kootenai National Forest, Mont.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Serious drought conditions during 1966–67 caused a general weakening and decline of vigor in Douglas-fir, resulting in heavy 1968 attacks by Douglas-fir beetles. Large volumes of Douglas-fir were killed on the Colville National Forest, Wash.; along the Lochsa River, Clearwater National Forest, Idaho; on the east-facing slopes of the Salmon River from Whitebird south to Riggins, Idaho; and throughout portions of the Bitterroot, Lolo, Flathead, and Lewis and Clark National Forests, Mont. Extensive salvage sales are in progress to remove infested dead timber. Continued drought conditions may result in increased beetle activity in some areas during 1970.

Pine engraver, *Ips pini* (Say), caused top kill of mature trees and infested patches of pole sized ponderosa pine on the Nezperce and Coeur d'Alene National Forest, Idaho, and on the Bitterroot, Lolo, and Flathead National Forests, Mont.

Most outbreaks occurred adjacent to logging, thinning, or road construction areas. Populations are expected to remain at the same level in 1970.

Fir engraver, *Scolytus ventralis* LeC. Outbreaks of this bark beetle declined in 1969. Light infestations occurred in scattered small groups of grand fir on the Nezperce, St. Joe, and Coeur d'Alene National Forests, Idaho. The downward trend will probably continue next year.

Pine butterfly, *Neophasia menapia* (Felder & Felder). Large numbers of pine butterflies were observed hovering over large ponderosa pine trees on the Nezperce National Forest, Idaho, and Lolo National Forest, Mont. As many as 200 adults were observed flying around trees near Missoula. Egg mass counts averaged 10 eggs per needle. Increased defoliation is expected next year.

A pine looper, identified as *Phaeoura mexicanaria* (Grote), caused serious defoliation of ponderosa pine lands of the Bureau of Indian Affairs and Custer National Forest near Lame Deer and Ashland, Mont. Pupal counts average four per square foot of duff sample. Populations are heavily parasitized by hymenopterous and dipterous parasites and a native virus is present. These factors may reduce looper populations next year.

Other insects. Occurrence of a larch sawfly, *Pristiphora leechi* Wong and Ross, was reported on the Coeur d'Alene National Forest for the first time since 1958 by Intermountain Station entomologists. Populations of fall webworms, *Hyphantria cunea* (Drury), caused widespread defoliation upon a variety of deciduous trees. Heavy spruce top killing by Engelmann spruce weevil, *Pissodes engelmanni* Hopk., occurred in spruce plantations on the Nezperce and Flathead National Forests.

CENTRAL ROCKY MOUNTAINS[5] (R-2)

By C. Kendall Lister and Donn B. Cahill
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Conditions in Brief

The mountain pine beetle continues to be the most important forest insect in the Central Rocky Mountains. Severe infestations in ponderosa pine have been found on the Black Hills,

[5] Includes forested lands in Colorado, Kansas, Nebraska, South Dakota, and Wyoming.

Roosevelt, and Pike National Forests, and on State and private lands. Static to decreasing populations occurred on the San Juan and Bighorn National Forests. Infestations in lodgepole pine exist on the Arapaho, White River, and Shoshone National Forests and on BLM and State and private lands.

Chemical control integrated with timber sales has reduced timber losses on the White River, San Juan, and Arapaho National Forests. Control on the Roosevelt and Black Hills National Forests has reduced tree mortality resulting in a holding action on salvage operations until sales are made.

The Engelmann spruce beetle infestations have become epidemic on the Medicine Bow, San Juan, and Grand Mesa-Uncompahgre National Forests. Populations are expected to increase throughout the Region.

Spruce budworm (western species) defoliation declined to the lowest level for the past decade. The decline was due to unseasonably late snow and freezing temperatures affecting mortality of the insect and new growth of the host.

Status of Insects

Mountain pine beetle, *Dendroctonous ponderosae* Hopk., remains a serious problem in stagnated, second-growth, and mature ponderosa pine stands on the Black Hills, Roosevelt, Pike, and San Juan National Forests affecting over a quarter-million acres.

On the Black Hills National Forest, there are 17,000 infested trees scattered over 200,000 acres, occurring mostly in groups of one to ten. In addition, on State and private lands an estimated 20,000 attacked trees occur mainly in large groups. Control was recommended to protect present and currently proposed timber sale areas.

The Roosevelt National Forest infestation continued to be a problem in stagnated, mistletoe-infected, mature trees on rough terrain.

The beetle activity on the Glade District of the San Juan National Forest has been controlled except in House Creek and Boggy Draw. Even with the accelerated sale program on the District, chemical control may be needed for 2 more years.

Mountain pine beetle activity is static or slightly decreasing at Dillon, Colo. Two new infestations near Granby and Hot Sulphur Springs, Colo. are epidemic. A joint timber sale program by BLM, State, and private landowners should control these infestations. Heavy tree killing in northwestern Colorado on BLM and State lands continues with no control planned.

The Engelmann spruce beetle. *Dendroctonus rufipennis* (Kirby), has become a serious problem. A recent survey in the Medicine Bow National Forest indicates that more than 7,000 standing trees are infested. The spruce beetle populations on the San Juan National Forest increased substantially in windthrown areas. Two small problem areas were found on the Grand Mesa-Uncompahgre National Forest. Logging and trap-tree programs are planned to control these spruce beetle infestations.

Spruce budworm (western species), *Choristoneura occidentalis* Free., infestations dramatically decreased in severity and acreage. The decrease was caused by subnormal temperatures accompanied by snow in the early summer; and by increased parasitism.

Douglas-fir beetle, *Dendroctonus pseudotsuage* Hopk., continues to be a problem in Douglas-fir stands on rough terrain in Colorado and Wyoming forests. The largest infestation of Douglas-fir bettle is located on the northern portion of the Bighorn National Forest.

Mature high risk ponderosa pine on the San Juan and Grand Mesa-Uncompahgre National Forests are being killed by attacks of a complex of *Dendroctonus* bark beetles. The beetles responsible are the mountain pine beetle, *D. ponderosae* Hopk., the western pine beetle, *D. brevicomis* LeC., and the roundheaded pine beetle, *D. adjunctus* Blandf. The removal of high-risk trees has been recommended to solve this problem.

Other insects. The tiger moth, *Halisidota ingens* Hy. Edw., has been found on ponderosa pine on the Roosevelt National Forest. Defoliation of aspen by fall webworm, *Hyphantria cunea* (Drury), was less noticeable than last year. A looper, *Lambdina* sp., was widely scattered in Colorado heavily defoliating oak—most

severely defoliated was an area of 2,000 acres on the White River National Forest. Defoliation caused by the spear-marked black moth, *Eulype hastata* (L.), was heavy on birch in the northern Black Hills. Western balsam bark beetle, *Dryocoetes confusus* Sw., continues to kill small groups of alpine fir throughout Colorado and Wyoming. Sugar pine tortrix, *Choristoneura lambertiana* (Busck), and a pine tip moth, *Rhyacionia* sp., caused terminal damage on ponderosa pine on the San Juan National Forest.

SOUTHWESTERN STATES (R-3) [6]

By H. W. Flake and C. J. Germain
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Conditions in Brief

Bark beetles continue to be the primary pest of concern to land managers in Region 3. Engelmann spruce beetle infestations on the Santa Fe National Forest and Fort Apache Indian Reservation have killed 9 million board feet of standing timber and pose an immediate threat to an additional 680 million board feet of mature spruce. Smaller centers of infestation are scattered throughout the Region. The roundheaded pine beetle is thwarting the management objective in the ponderosa pine sapling and pole stands on the Lincoln National Forest and Mescalero-Apache Indian Reservation. A hundred thousand acres are infested by this pest. An increase in mountain pine beetle activity was noted in northern New Mexico.

Defoliator activity remains light. Spruce budworm (western species) populations are endemic. Two Douglas-fir tussock moth infestations were active in Arizona; one collapsed from a natural virus epizootic; heavy defoliation on 200 acres is expected in the other area. Southwestern pine tip moth remained active on 100,000 acres in Arizona.

Cultural control was directed against the spruce beetle, mountain pine beetle, and an Arizona five-spined ips beetle. Chemical control methods were used to suppress populations of the pinyon needle scale and western tent caterpillar. Maintenance control using Thuricide 90 T was directed against the Nevada buck moth. Refinement of pest control techniques, using the herbicide Silvisar 510, is continuing for bark beetle control.

Other forest pests, primarily in recreational areas, are requiring close surveillance.

Status of Insects

Engelmann spruce beetle, *Dendroctonus rufipennis* (Kirby) is nearing epidemic conditions throughout the mature and overmature spruce forests of the Southwest. Volume losses are excessive, with activity intensifying at two major infestation centers and nine minor centers in the Region.

The highly aggressive beetle populations on the Santa Fe National Forest, near Espanola, N. Mex. have resulted in 1,400 acres infested this year, with subsequent destruction of 5 million board feet of spruce timber. The epicenter, 506 acres of infested spruce, was salvaged this year. As a serious situation continues to exist, suppression design will be oriented toward an integrated cultural control program in an effort to protect 80 million board feet of timber adjacent to the infested area.

On the Fort Apache Indian Reservation, near Whiteriver, Ariz., Engelmann spruce beetle activity has risen sharply. In the Mt. Baldy area, 2,700 acres are known to be infested, where 4 million board feet of spruce have already succumbed to this pest. A total of 600 million board feet of virgin spruce is threatened on Indian land, plus an additional 10 million board feet on the adjoining Apache National Forest.

In addition to the above two major areas, nine smaller centers are active, four in northern New Mexico and five in northern Arizona. The four in northern New Mexico are located on the Philmont Scout Ranch and on the Carson, Cibola, and Santa Fe National Forests. The five in northern Arizona are on the Apache, Coconino, Coronado, and Kaibab National Forests, and on Grand Canyon National Park. Control through logging and burning of residual slash

[6] Includes all forested lands in Arizona and New Mexico and National Park Service land in southern Colorado and western Texas.

is the primary suppression approach. Further deterioration of mature and overmature spruce forests of the Southwestern Region is expected.

The roundheaded pine beetle, *Dendroctonus adjunctus* Blandf., and associated Ips are epidemic on 100,000 acres in the Lincoln National Forest and Mescalero-Apache Indian Reservation east of Cloudcroft, N. Mex. Summer surveys showed up to 44 infested ponderosa pine saplings and poles per acre. Attacks are confined primarily to heavily stocked 2- and 3-site class stands. Late fall post-beetle flight surveys indicate a continuing epidemic trend, with larger diameter classes now being attacked. Historically, many outbreaks of the roundheaded pine beetle have occurred in the Southwest. The bionomics of this pest are not understood; total effect on the stand is unknown. Surveys are in progress to determine the pest's impact as it relates to stand composition.

Mountain pine beetle, *Dendroctonus ponderosae* Hopk. Mortality of mature ponderosa pine, caused by the mountain pine beetle, increased on Carracas Mesa, Carson National Forest, west of Chama, N. Mex. Survey data showed scattered groups of trees on 6,000 acres infested with a heavy and vigorous beetle population. Timber sale modification, coupled with silvicultural practices that maintain stand vigor, has been recommended to control this infestation.

A southwestern pine tip moth, *Rhyacionia neomexicana* (Dyar), continues to cause stem deformity and height loss to ponderosa pine seedlings on the Sitgreaves National Forest, Winslow, Ariz. Survey results show an increasing trend over 1968. An estimated 100,000 acres are heavily infested. Impact studies, initiated in 1968, indicate that tip moth damage may not be as significant as previously thought. Lateral shoots quickly assume dominance over infested terminals and attain appreciable height growth. The greatest adverse effect from the tip moth appears to be on recently planted seedlings on poor sites.

Douglas-fir tussock moth, *Hemerocampa pseudotsugata McD.* Two infestations on the Tonto National Forest in Arizona remained active in 1969. At Aztec Peak, north of Globe, 400 acres showed heavy defoliation. During the fall egg mass survey, no new egg masses were found. The virus epizootic that had developed over the past 2 years culminated. Little defoliation is expected in the area next year.

On Pinal Peak, south of Globe, 200 acres of mixed conifiers was moderately defoliated. The fall egg mass survey indicates an increase in the infestation, with heavy defoliation expected in 1970. No evidence of virus has been detected on this population. Both infestations have proved valuable study areas for scientists from the Pacific Northwest Forest and Range Experiment Station working on population evaluations and epizootiology.

An Arizona five-spined ips, *Ips lecontei* Swaine, continues to cause heavy mortality of sapling and poles in logging areas on the Prescott National Forest. Three hundred and seventy acres are infested by this pest. Stocking of the featured age class has been reduced below acceptable levels. Modification of logging and slash disposal methods, initiated last year, were not effective in reducing the damage.

A pinyon needle scale. *Matsucoccus acalyptus* Herb., remained epidemic on the South Rim of Grand Canyon National Park. The National Park Service treated 2,604 trees with 0.5 percent dimethoate formulation to protect esthetic values at viewpoints and lodge areas.

Western tent caterpillar, *Malacosoma californicum* (Pack.). Heavy populations of this defoliator on the planted cottonwoods in the Glen Canyon National Recreation Area, near Page, Ariz., required suppression by the National Park Service. Two hundred and twenty-one trees were treated with carbaryl. Excellent control was obtained.

Spruce budworm (western species), *Choristoneura occidentalis* Free. Spruce budworm populations continue to decline in Region 3. At present, the pest is endemic. Population monitoring surveys will continue on an annual basis in stands previously known to have been infested.

Other insects. The red turpentine beetle, *Dendroctonus valens* LeC., was active on the North Rim, Kaibab National Forest. Scattered groups

of overmature ponderosa pine were killed. The California five-spined ips, *Ips confusus* (LeC.), continues to take its toll of pinyon pine around home construction sites and other areas of stand disturbance throughout the Region. Populations of the Douglas-fire beetle, *Dendroctonus pseudotsugae* Hopk., remain light, with scattered attacks occurring in the Chuska Mountains, Navajo Indian Reservation. An engraver beetle, probably *Ips utahensis* Wood, is responsible for scattered top kill of mature spruce on the North Rim of Grand Canyon National Park and the Kaibab National Forest. Top-killed trees are subsequently killed by additional attacks from *Ips* or the spruce beetle.

The Nevada buck moth, *Hemeleuca nevedensis* Stretch, continues to require maintenance control to protect native cottonwood on the White Sands National Monument. Thuricide 90 T was used to suppress the population. An unidentified tussock moth, *Hemerocampa* sp., is building up on boxelder in Whitewater Campground near Glenwood, N. Mex. This insect required suppressive measures in 1966. A southwestern tent caterpillar, *Malacosoma incurvum incurvum* (Hyman Edwards), is increasing in the Sabino Canyon Recreation Area, Coronado National Forest, near Tucson, Ariz. Control measures may be necessary in 1970 to protect the esthetic values of this high-use recreational area.

SOUTHERN AND SOUTHEASTERN STATES (R-8)[7]

By G. L. Downing, J. D. Ward and W. M. Ciesla[8]
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Conditions in Brief

The severe southern pine beetle outbreak in southeast Texas declined dramatically during the year, while at the same time spreading to new areas. An aggressive infestation developed rapidly on the Cherokee National Forest in Tennessee. This is part of a 2-year-old infestation in the Southern Appalachian Mountains. Other southern pine beetle infestations occurred in North Carolina, South Carolina, Louisiana, Arkansas, and Alabama.

Ips engraver beetles caused extensive tree killing in Texas, Arkansas, Oklahoma, Georgia, and Florida. In Mississippi, tremendous populations of these insects built up in down trees resulting from Hurricane Camille. By late fall, they were beginning to invade green standing trees over much of the 1.9 million acre hurricane damaged area. The black turpentine beetle also began attacking hurricane-damaged trees by late fall.

Preventive spraying for the balsam woolly aphid was discontinued and protection zones established. Treatment will be confined to these zones, but will be applied only after an infestation is known to occur.

The forest tent caterpillar caused moderate to complete defoliation over 42,000 acres of bottomland hardwoods in southwestern Alabama and 90,000 acres in southern Louisiana.

Other infestations included 82,000 acres of hardwood defoliation by walkingsticks in Arkansas and Oklahoma; several localized outbreaks of sawflies scattered over several States; Nantucket pine tip moth in Virginia, North Carolina, and Florida; tree killing and leader damage by the deodar weevil *Pissodes nemorensis* Germ. in Louisiana, Mississippi, and Texas; and continuation of fall cankerworm defoliation in Virginia and North Carolina.

Status of Insects

Southern pine beetle. *Dendroctonus frontalis,* Zimm. A sudden increase in southern pine beetle activity occurred on the Tellico District of the Cherokee National Forest in Tennessee and threatened to become one of the severest outbreaks in the Southeastern United States in recent years. This outbreak is part of a widespread epidemic which began in parts of the Southern Appalachian Mountains during the fall of 1967. The beetle population on the Tellico

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[7] Includes forested lands in Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, and Virginia.

[8] Entomologists at Atlanta, Ga., Asheville, N.C., and Alexandria, La., respectively.

was endemic in the spring due to considerable brood mortality caused by freezing winter temperatures and widespread woodpecker predation. However, after 5 months of favorable weather, the level of infestation increased to 747 infested trees per thousand acres of host type. As many as 75 green infested trees were found around a single red-topped tree during

F–519878

Trees killed by the southern pine beetle are being utilized for pulpwood.

the fall evaluation. A vigorous control program was undertaken on the Tellico and adjoining private lands with emphasis on removal of infestations by commercial sales or piling and burning where salvage was not feasible.

Northeast of the Tellico outbreak, in a remote and rugged section of the Great Smoky Mountains National Park, the southern pine beetle continued to inflict heavy timber losses. A fall survey indicated that as much as 1,300 acres of host type may have been destroyed since the epidemic began. Despite a high level of 95 infested trees per thousand acres of host type, this outbreak may be subsiding since beetle brood densities are relatively low and parasites and predators are more numerous.

A September survey of the Tusquitee District of the Nantahala National Forest of western North Carolina indicated 7.4 infested trees per thousand acres of host type with brood densities of 553 insects per square foot of bark. A late fall survey of 15 counties in the Piedmont revealed 1,806 spots and a rapidly expanding southern pine beetle population.

Southern pine beetle activity continued at moderate to high levels throughout North Carolina. The North Carolina Division of Forestry reported fluctuating infestation levels across the State and a late season increase in all previously infested counties. The largest area covered approximately 250 acres in Lenoir and Craven Counties.

Damage by the southern pine beetle decreased to low levels on the Francis Marion and Sumter National Forests in South Carolina. Prompt harvesting of beetle infested trees in the western part of the State greatly reduced the activity in this area. A cooperative survey conducted by the South Carolina Division of Forestry and the USDA Forest Service, Division of Forest Pest Control, revealed that staggering timber losses occur even in periods of moderate beetle activity. More than 9½ million board feet of pine sawtimber and 25,000 cords of pulpwood were lost to bark beetles over a 24-county area in the Piedmont and Sandhills regions of South Carolina. The southern pine beetle was cited as the principal bark beetle causing these losses.

Southern pine beetle activity has continued to decrease on the Chattahooche National Forest in Georgia. Prompt harvesting of beetle infested trees has apparently played an important role in reducing losses on private lands in Georgia. The Virginia Division of Forestry reports a population decrease in all areas except Campbell County where an increase in activity occurred.

New areas of southern pine beetle infestations were detected in the Gulf South early in the year, but most outbreak areas declined to endemic levels during mid- and late summer following a prolonged period of hot, dry weather. In southeastern Texas, where the southern pine beetle has caused severe losses since 1958, the areas of infestation spread to the north and west encompassing a gross area of 6 million acres in 1969, but the total number of infested trees was less than one-third of 1968 levels. Infestations declined to endemic levels on the National Forests in Texas during late summer, and by October the southern pine beetle was a secondary invader in trees initially attacked and killed by *Ips* engraver beetles.

New areas of infestation were detected in northeastern Louisiana and adjoining portions of Arkansas, this being the first report of infestations in Arkansas since the early 1900's. Scattered infestations were detected on six of seven districts of the Kisatchie National Forest in central Louisiana. Outbreak areas on private lands in central and southwestern Louisiana declined to endemic levels during late summer and direct control operations were terminated.

The southern pine beetle remained at low levels on the Homochitto National Forest and adjoining private lands in southwestern Mississippi and the Talladega National Forest in central Alabama for the second consecutive year. Epidemic populations persisted on the Bankhead National Forest in northwestern Alabama. Emphasis was placed on the removal of infested trees by commercial sales in all areas of southern pine beetle infestation and the use of chemical control was further minimized.

Engraver beetles, *Ips spp.* Engraver beetles caused losses in a number of areas of the Gulf

F–519880

Utilization of beetle-killed timber has proven to be an effective method for reducing timber losses in the Southeastern United States.

South, following a prolonged period of hot, dry weather during midsummer. Engraver beetles replaced the southern pine beetle as the primary tree killer in east Texas. *Ips avulsus* (Eichh.) killed groups of young pines in several areas on the Ozark National Forest, Arkansas and the Tiak District of the Ouachita National Forest, Arkansas and Oklahoma.

Hurricane Camille caused severe damage and windthrow in southeastern Mississippi on nearly 1.9 million acres of commercial forest lands. Three species of engraver beetles, *I. avulus* (Eichh.) *I. grandicollis* (Eichh.), and *I. calligraphus (Germ.)* rapidly invaded windthrown material and completed two generations by mid-October. Some invasion of standing trees was in progress by the end of the year.

A severe ice storm along the Atlantic Coast during February caused an estimated $60 million worth of timber damage in South Carolina and a considerable amount of damage in North Carolina. An outbreak of *Ips* was anticipated in this area but no serious infestations were detected. *Ips* also failed to build up in wind-damaged timber on the Tellico and Ocoee Districts of the Cherokee National Forest.

A post control evaluation of an *Ips* outbreak was conducted in an 8,000-acre area in south-central Georgia. Results of the evaluation indicated that most of the infestation had been harvested or controlled by piling and burning. One landowner clearcut over 300 acres of 15-year old slash pine in the outbreak area.

The Florida Forest Service reported a Statewide decline in insect-caused tree mortality but cited *Ips* as the major pest in the death of over 1.2 million pine trees in central and northern Florida.

Balsam woolly aphid, *Adelges piceae,* (Ratz.) The Fraser fir type on Mount Rogers National Recreation Area continued to be the only major fir type free of infestation in the three State area of North Carolina, Tennessee, and Virginia. Elsewhere, the aphid continued to thrive in the inaccessible areas which so characterize the range of Fraser fir. Aerial surveys carried out over the inaccessible fir type revealed à new 25-tree infestation in the Balsam Mountains south of Waynesville, N. C. This represents the southernmost occurrence of the aphid in the southeast.

During 1969 emphasis was placed on establishment of "protection boundaries" in selected areas of high value fir type where control is feasible, if required. Preventive spraying was discontinued and the goal changed to treating only after infestations are found within protection zones. Intensive trapping procedures carried out in the newly established protection areas this year revealed two active infestations on Roan Mountain in North Carolina, one on Mount Mitchell State Park in North Carolina, and one in the fir seed trees on Linville River State Forestry Facility in Crossnore, N.C.

Black turnpentine beetle, *Dendroctonus terebrans* (Oliv.). Populations of this beetle remained endemic throughout the southern and southeastern States except in stands weakened by disturbances such as logging operations, wind and electrical storms, drought, or flooding. The State of Florida reported a 40 percent decrease in pine tree mortality since 1968 with a great reduction in black turpentine beetle activity. Scattered infestations were observed in an 800-acre tract in North Carolina. South Carolina also reported a reduction in activity of this pest. A late fall buildup of the black turpentine beetle was reported in trees damaged by Hurricane Camille in Mississippi.

Forest tent caterpillar, *Malacosoma disstria* Hbn. Heavy infestations of the forest tent caterpillar again occurred on the bottomland hardwood forests of the Mobile and Tensaw River basins in southwestern Alabama. A gross area of 42,475 acres was defoliated during 1969 with 26,850 acres suffering complete defoliation. Water tupelo was the preferred host in these outbreaks.

In Louisiana, this insect defoliated 80,000 acres of bottomland hardwoods near Morgan City, and 10,000 acres along the Mermentau River bottom near Lake Charles.

Localized outbreaks of the forest tent caterpillar occurred in west central Florida and two areas of river bottom land in western Kentucky. A 0.5 percent malathion spray applied in 1968 was apparently effective in reducing the 1969 eastern tent caterpillar, *M. americanum* (Fab.), population on the Rocky Knob District of the Blue Ridge Parkway in Virginia.

F–519882

A severe ice storm in February 1969 caused millions of dollars of timber damage in North and South Carolina and left thousands of acres of pine highly susceptible to beetle outbreaks.

Walkingstick, *Diapheromera femorata* (Say), reached epidemic levels for the first time since 1963 and defoliated 82,000 acres of hardwood forests on the Ouachita National Forest in Arkansas and Oklahoma. Scarlet oak was the preferred host. Other oaks, black locust, black cherry, and several other hardwoods were also defoliated. Heaviest defoliation occurred near the summits and on the north slopes of the higher mountains in the outbreak area.

Pine sawflies, *Neodiprion* spp. Several species of this pest continued to cause light to heavy defoliation of southern yellow pines in Tennessee, Virginia, North Carolina, Florida, Georgia, and Kentucky. The only report of timber mortality resulting from sawfly infestations came from Taylor County, Fla. where heavy defoliation by the red-headed pine sawfly, *N. lecontei* (Fitch), was followed by an infestation of engraver beetles, *Ips* spp., and weevils, *Pissodes* sp., resulting in the death of about 500 trees. The Florida Forest Service reported good control of the red-headed pine sawfly in a 1-year-old slash pine plantation in Taylor County. Approximately 900 acres of private lands were aerially sprayed with Baygon during April.

F–519879

A young loblolly pine that has been completely defoliated by the redheaded pine sawfly.

The red-headed pine sawfly caused severe defoliation of a loblolly pine plantation near Houston, Tex. Localized infestations of the sawfly occurred along the Natchez Trace Parkway in Mississippi. The sawfly, *N. taedae linearis* Ross, caused defoliation of loblolly pines near Camden, Ark. This sawfly also defoliated loblolly pines in two areas in northwestern Alabama; however, considerable late instar larval mortality, attributed to a polyhedral virus, was observed in these outbreak areas. Infestations of *N. excitans* Roh. defoliated loblolly pines on 1,000 acres near Jasper, Ala. and 3,000 acres in eastern North Carolina.

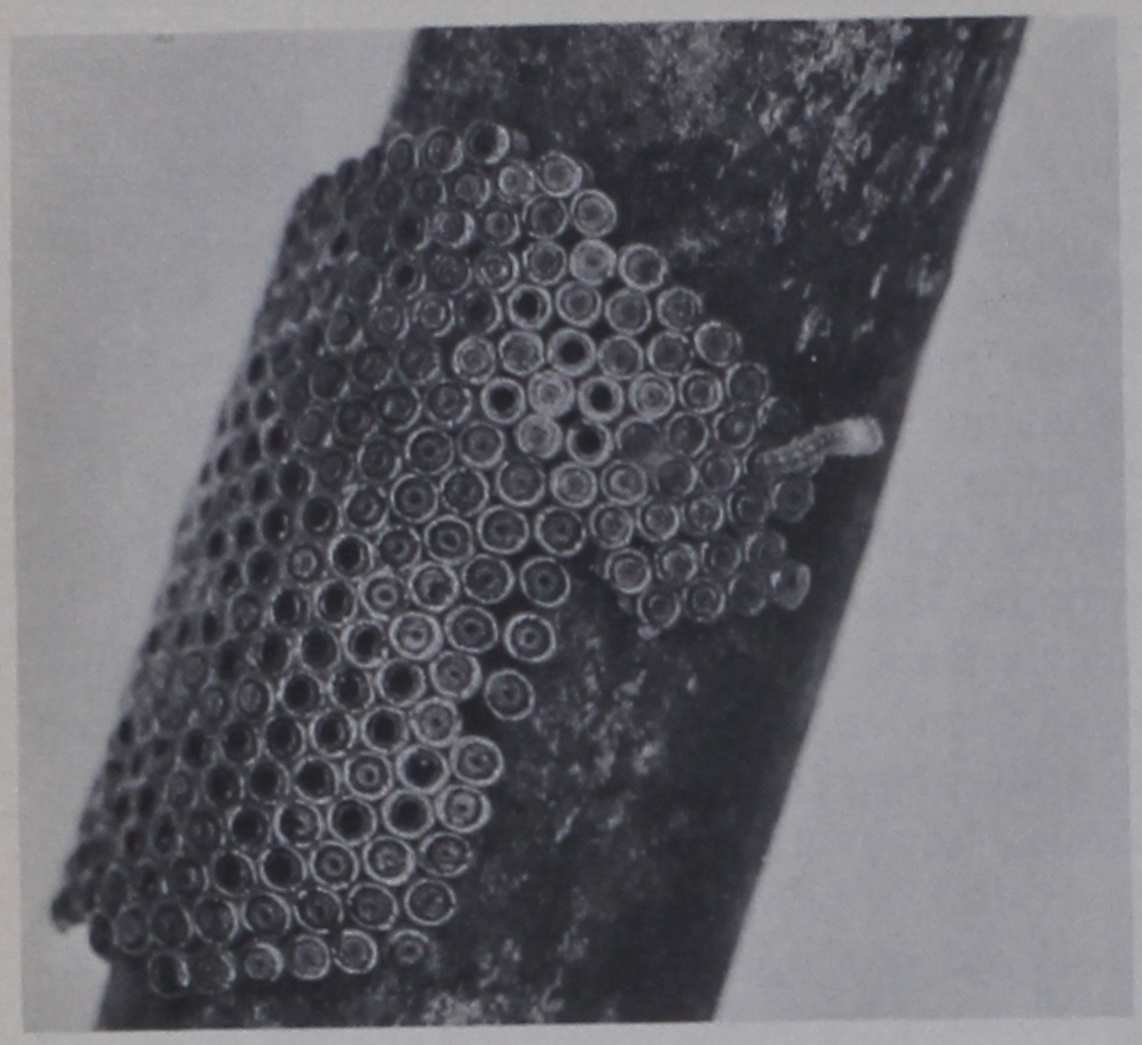
Nantucket pine tip moth. *Rhyacionia frustrana* (Comstock). Severe infestations of this tip moth were reported in the Virginia coastal plains. Localized outbreaks by this species were also reported in North Carolina, Florida, and South Carolina.

Results of a field pilot test of phorate systemic insecticide revealed excellent control of *R. frustrana* in a 3- to 5-year-old grafted loblolly pine orchard near Goldsboro, N.C. This control measure should be considered only on special use areas and its use restricted to qualified personnel.

The Florida Division of Plant Industry reported a light infestation of an 850-acre slash pine plantation in Taylor County by the subtropical pine tip moth, *R. subtropica* Miller.

A Deodar weevil, *Pissodes memorensis* Germ. Widespread mortality of leaders of young open grown loblolly pines due to adult feeding occurred over a three-State area. Damage was observed near Shreveport and in Natchitoches Parish, La. and Meridian, Miss. Heaviest infestations occurred in Angelina County, Tex. where groups of several hundred trees were killed by adult feeding.

Fall cankerworm, *Alsophila pometaria* (Harr.) A light infestation was observed on the



F–519881

Larva of fall cankerworm emerging from an egg mass. Dark spots on egg mass are individual eggs from which larvae have emerged.

Coweeta Hydrologic Laboratory in western North Carolina while heavy defoliation of oak and hickory occurred on the adjoining Wayah District of the Nantahala National Forest. Excellent control of fall cankerworm was achieved on 90 acres of a 1,400-acre outbreak in Prince William County, Va. following a test application of Gardona insecticide by the Virginia Division of Forestry.

Other insects. An undetermined species of red spider mite caused heavy damage in a 70-acre scotch pine plantation in eastern Kentucky. Scattered stands of oak on the George Washington National Forest and adjoining private lands in Virginia were damaged by the periodical cicada, *Magicicada septendecim* (L.). The fall webworm, *Hyphantria cunea* (Drury), continued to be a problem in recreation areas throughout the Southeast. A scarab beetle, *Anomala oblivia* (Horn.) commonly found in the northeastern States, was found defoliating new growth of slash pine in southwestern Georgia and northeastern Florida.

For the second straight year, aerial and ground surveys revealed a decline in populations of the oak leaf tier. *Croesia semipurpurana* (Kearf.). in and near the George Washington National Forest in Virginia.

An unidentified tortricid defoliated live and blackjack oaks on 100,000 acres in Colorado and LaVaca Counties, Tex. The bagworm, *Thyridopteryx ephemeraeformis* (Haw.), defoliated eastern redcedar and sassafras on the Pea Ridge National Military Park in northwestern Arkansas. The fall webworm, *Hyphantria cunea* (Drury), damaged walnut, pecan, persimmon, and other hardwoods in and near the Platt National Park, Okla. A leaf mining weevil, *Odontopus calceatus* (Say) damaged magnolia in residential areas of Pineville, La.

NORTHEASTERN STATES (R-9)

By Robert P. Ford
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Conditions in Brief

Over 3 million acres of forest land in the Northeast were defoliated by insects. Insect attacks on the stems, roots, buds, and seeds of forest trees also occurred on vast acreages.

The gypsy moth defoliated oaks and other hardwoods from New Hampshire to Pennsylvania and was reported for the first time in Maryland and Delaware.

Spruce budworm populations in Maine and the Lake States increased to critical proportions. Chemical suppression is planned in Maine in 1970 to save millions of trees that were heavily defoliated this year.

The saddled prominent infestation was widespread in the Northeast from New Hampshire to Minnesota. Except for the use of chemicals on small acreages, natural controls will be relied upon to suppress the outbreaks.

Cankerworm and leaf roller populations accounted for defoliation on vast areas, but are expected to decrease considerably in 1970.

Twig damage by tip moths and spittlebugs is increasing throughout the Northeastern Area.

White-pine weevil host preference was ex-

panded to include Scots pine and white spruce. Heavy damage occurred on white pine, Norway spruce, and red pine.

Sawfly populations were generally lower except for the Virginia pine sawfly which showed a decided trend upward.

Damage by the beech scale-nectria complex spread further to the west and north with the tree killing front now located in western Vermont.

Cold weather prevented further spread of the balsam woolly aphid infestations but trees in already infested areas continued to die.

Weather factors provided control of a potential outbreak of the pine tussock moth in Wisconsin.

Surveys in the Lake States and Missouri indicate an average loss of 36 percent of shortleaf and red pine cones due to insect attack.

Defoliators such as the oak skeletonizer, maple leaf cutter, maple trumpet skeletonizer, forest tent caterpillar, and the orange-striped oakworm were of considerable importance in 1969.

Status of Insects

Gypsy moth, *Porthetria dispar* (L). Populations increased sharply in southern New England, Pennsylvania, New York, and New Jersey. Over 212,000 acres were defoliated by this insect which was introduced into the United States 100 years ago. Male moths were found for the first time in Delaware and Maryland. New York and New Jersey reported successful control on a total of 61,250 acres with aerial applications of carbaryl. Populations are expected to be very high in 1970.

Spruce budworm, *Choristoneura fumiferana* (Clem.). Heavy infestation on more than 200,000 acres in Aroostock County, Me. caused considerable tree mortality. With increased damage expected in 1970, plans are being made to control this insect. In Minnesota, where nearly 500,000 acres were defoliated by spruce budworm, a cooperative State-private-Federal suppression project on 10,000 acres was needed to suppress the population. No suppression projects are planned in 1970 in Minnesota or in Michigan and Wisconsin where new infestations were detected.

Jack-pine budworm, *Choristoneura pinus* Free. Populations declined in the Lake States. Landrin appeared more effective than Gardona, Matacil, or Sevin for control of the budworm in Wisconsin trials. Infestations are expected to remain at present levels in 1970.

Saddled prominent, *Heterocampa guttivitta* (Wlk.). Over 196,000 acres of beech and sugar maple woodlands in Pennsylvania, Massachusetts, Vermont, and New Hamsphire were heaviy defoiated by this insect and its allies. New York sustained 953,575 acres of defoliation and found it necessary to use carbaryl on 13,794 acres of recreation lands and sugar bushes to prevent serious damage. Natural control factors, especially larval disease, are greatly influencing population levels. New infestations and collapse of old infestations are expected in 1970. The USDA Forest Service, and the States of Vermont, New Hampshire, Massachusetts, and New York are cooperating with the Applied Forestry Research Institute at Syracuse, N.Y. in the development of a pupal survey system.

Cankerworms and loopers. The complex of these insects consists chiefly of fall cankerworm, *Alsophila pometaria* (Harris); elm spanworm, *Ennomos subsignarius* (Hbn.); Bruce spanworm, *Operophtera pruceate* (Hulst); spring cankerworm, *Paleacrita vernata* (Peck); linden looper, *Erranis tiliaria* (Harris); and a red maple spanworm, *Physostegania pustularia* (Guénee). These insects cause varying degrees of defoliation in scattered locations throughout the Northeastern Area. The elm spanworm is expected to increase in Wisconsin and Connecticut in 1970. Defoliation by the complex decreased in New Jersey but remains a problem on half a million acres. Fall cankerworm infestation decreased in Vermont because of unfavorable weather, but the infested area increased in Maine.

Leaf rollers and tiers, *Croesia semipurpurana* (Kearf.), *Pseudexentera cressoniana* (Clements), and *Archips* spp., defoliated approximately 1 million acres of oak forests throughout

F–519875

The oak leaf tier is the predominant insect species of a complex responsible for defoliation of red oaks throughout the Northeast.

Northeast in 1969. Populations of these insects were down in New Jersey, Pennsylvania, and West Virginia. In Michigan, the complex caused tree mortality which is expected to be extensive in 1970. A reduction in defoliation is anticipated in all States except Wisconsin, Minnesota, and Michigan.

Forest tent caterpillar, *Malacosoma disstria* Hbn. New infestations of this insect were detected in Ohio, West Virginia, Pennsylvania, and Minnesota. Populations are expected to increase in these areas. About 200 square miles were severely defoliated in Minnesota. Defoliation was light in Michigan and Illinois. Virus infection is expected to control the outbreak in Illinois. Natural control factors are keeping the insect at low levels in Vermont.

Beech bark disease, beech scale, *Cryptococcus fagi* (Baer.) and *nectria coccinea* Pers. var. *faginata* L.W.&A. This association of an insect and fungus continues unabated throughout New England and New York. The killing front is moving westward and northward in New York and Vermont. Populations of the scale are static at a high level. Suppression methods in the forest are unknown. Salvage operations cannot keep up with the 15 million board foot annual loss in Vermont.

Oak skeletonizer, *Bucculatrix ainsliella* Murt. New infestations of this defoliator are reported from Connecticut, Wisconsin, New Jersey, and Massachusetts. Populations are expected to increase in 1970. Old infestations in New England and New York increased in area and intensity.

White pine weevil, *Pissodes strobi* (Peck). Heavy damage to white pine and white spruce planations occurred in New Hampshire. Increased damage to blue spruce and Scots pine plantings was reported in Vermont. Weevil populations are increasing in Pennsylvania. Maine is conducting insecticide trials in an attempt to find a less expensive and more reliable method of control.

Saratoga spittlebug, *Aphrophora saratogensis* (Fitch). Populations of this insect are spreading throughout the area. Damage was reported in isolated cases in Vermont and Maine. A low volume application of malathion (10 fluid ounces per acre) was used to suppress spittlebug infestations on 1,000 acres in Wisconsin and 5,000 acres in Michigan. Surveys indicated an increase in outbreaks in 1970.

Virginia pine sawfly, *Neodiprion pratti pratti* (Dyar). West Virginia and Ohio reported sharp increases in damage caused by this pest. Malathion treatments were moderately successful in reducing populations. Increases in area and intensity of damage by the insect are expected in 1970.

Nantucket pine tip moth, *Rhyacionia frustrana* (Comst.). Attacks by this insect and related pests increased in Missouri, Massachusetts, and New Jersey. Populations of the tip moths are expected to increase in 1970.

Red-headed pine sawfly, *Neodiprion lecontei* (Fitch). This insect defoliated over 500 acres in the Lake States. Malathion was used to treat 100 acres in Michigan with excellent results. Michigan will probably treat 400 acres in 1970. Populations are at very low levels in eastern areas, and only scattered light infestations were found from Maryland to Missouri.

Balsam woolly aphid, *Adelges piceae* Ratz. Fir trees along the coast of Maine are heavily

infested by this insect. Tree mortality and degrade continued in 1969. The aphid population was drastically reduced by the colder winter in New Hampshire. Tree mortality levels remained static in New Hampshire, but were lower in Vermont where 7,000 acres are infested.

A maple bark scale, *Cryptococcus williamsi* (K. & H.) No new infestations were detected in 1969. Existing populations were reduced to low levels probably by cold temperatures. Surveys revealed no association of the scale with a tree disease.

Maple trumpet skeletonizer, *Epinotia aceriella* (Clem.). Infestations increased sharply throughout New England with the highest levels on record begin surpassed in Vermont. No suppression by chemicals is anticipated because the insect defoliation occurs very late in the season.

Maple leaf cutter, *Paraclemensia acerifoliella* (Fitch). Populations of this pest increased to outbreak proportions for the first time since 1958 in Vermont, New Hampshire, and Massachusetts. Infestations are expected to decrease in 1970 due to disease and parasitism.

F–519876

Larva of the living beech borer, a common degrader of red oak.

Seed and cone insects. *Conophthorus* spp., *Dioryctria* spp., *Eucosma* spp., *Laspeyresia* spp., and *Rubsaamenia* spp. Surveys conducted in the Lake States and in Missouri showed cones of red pine and shortleaf pine sustaining a wide range of infestation up to 92 percent. Cone production is expected to increase in 1970 while insect populations remain at present levels.

Pine tussock moth, *Dasychira plagiata* (Wlk.). The Minnesota Department of Agriculture experimented with Sevin and Matacil for control of this pest and obtained reasonably good control with both insecticides. The State expects to treat about 1,000 acres in 1970. Weather conditions were responsible for suppressing an anticipated infestation in Wisconsin.

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